RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol. 59 AUGUST, 1952 No. 2

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RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

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Vol. 59 AUGUST 1952 No. 2

Roentgen Therapy in Vitreous Hemorrhage and Hemorrhagic Glaucoma[1]

C. E. HUFFORD, M.D., F. C. CURTZWILER, M.D., and J. L. ROBERTS, M.D.

THE USE OF THE roentgen ray for hemorrhage in the eye is not new. Gradle (2) reported his experience with this method of therapy for retinal vein thrombosis in 1937, giving credit to Hessberg for using roentgen irradiation as a therapeutic measure in retinal hemorrhage as early as 1920. Guyton and Reese (5) have more recently reported their use of x-rays in cases of retinal disease characterized by new-formed blood vessels.

Schultz (3) credits von Graefe with reporting recurring intraocular hemorrhage in young adults as early as 1855 and states that Henry Eales of Birmingham gave the first adequate description of this condition in a paper published in 1880, entitled "Cases of Retinal Haemorrhage Associated with Epistaxis and Constipation."

Gradle concluded that in his experience roentgen therapy was not entirely successful in preventing secondary glaucoma in cases of retinal vein thrombosis, but he did feel that some value was indicated by his "few statistics." He did not believe that blood clots were more quickly absorbed, nor did he feel that final vision was improved. He did conclude, however, that the results warranted continued use of the method of treatment, perhaps with some alteration of technic.

On the other hand, Dr. Wm. J. Benedict, of Rochester, Minn., stated, in a discussion of the paper by Guyton and Reese, that there is no question that blood in the vitreous will be absorbed much more rapidly after irradiation than if the disease is not treated. He added that in cases of diabetic retinosis with hemorrhage, irradiation will produce more rapid absorption of repeated hemorrhages, but will have no noticeable effect upon the proliferative changes in the vessels.

A most satisfactory synopsis of the history of the use of roentgen irradiation for hemorrhagic alterations of the retina and an explanation of its *modus operandi* are to be found in a discussion of the Guyton and Reese paper by Dr. Moacyr E. Alvaro, of São Paulo, Brazil, who credits Hessberg with the first use of the roentgen ray in a case of hemorrhagic glaucoma in 1949. Dr. Alvaro noted the difference of opinion regarding the results of irradiation and listed Basile, Saul, Zingale, Loewenstein, Reise, Schmerer, Hessberg, di Marzio, and Jendralski as proponents, while Cordes, Schnyder and Foster, von Grósz, Stock, Mylius and Lorey were quoted as being less enthusiastic. Alvaro is himself in favor of radiation therapy for repeated retinal hemorrhages of various kinds, and for retinitis proliferans.

We have treated, in the years 1933 to 1951, 74 cases of vitreous hemorrhage,

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

including 4 cases of hemorrhagic glaucoma.

As stated by Reese (Guyton and Reese), the etiology of conditions producing recurring vitreous hemorrhages is difficult to define, since the group is indeed heterogeneous. However, with Rutherford (1) as an authority, we may for the purposes of clarification become didactic and classify the causes of vitreous hemorrhage as follows:

I. Trauma (A wound involving the ciliary body may produce an intra-ocular hemorrhage.)
II. Diseases of the choroid and retina
III. Myopia
IV. Glaucoma
V. Hypertension
VI. Systemic diseases: (*a*) diabetes, (*b*) tuberculosis
VII. Atheroma
VIII. Recurrent hemorrhages in young persons, chiefly males—Eales' disease
IX. Tumors

Again referring to Rutherford, we call attention to the fact that the underlying cause of vitreous hemorrhage may be difficult to determine at once, since nothing can be seen through the blood clot by the ophthalmoscopist. In many cases the late appearance of the retina may be the same regardless of the underlying cause. It is known that retinitis proliferans, detachment of the retina, secondary glaucoma, and secondary cataract may be the late result of any massive hemorrhage.

Denison (4) remarks that retinitis proliferans (Eales' disease) is characterized by recurrent hemorrhages into the vitreous body and retina, and that young males, usually between the ages of eighteen and thirty years, are affected. Thus, he groups under Eales' disease many etiologic factors, including trauma as one, while he also recognizes toxic and infectious conditions as possible causes. He states further that some eye specialists regard a positive tuberculin test as sufficient proof of a tuberculous lesion of the eye. There seems, therefore, to be considerable variation in opinion concerning the etiology of vitreous hemorrhage.

We feel that we can with fair honesty and accuracy report the following conditions as etiological in our series of cases: first, tuberculosis; second, trauma; third, inflammatory conditions of the uveal tract; fourth, hypertensive disease; fifth, diabetes. In a sixth group the cause is unknown or unspecified.

In hemorrhagic glaucoma our experience with roentgen therapy is limited to 4 cases. The results, however, have been gratifying.

TECHNIC OF THERAPY

Our technic does not differ basically from that reported by Gradle and that mentioned by Alvaro in his discussion of the paper by Guyton and Reese. We have used a peak kilovoltage of 200 at 15 ma. The beam is filtered by a Thoraeus composite of 0.2 mm. of tin plus 0.25 mm. of copper and 1.0 mm. of aluminum, and is delivered through a cone of 2.5 cm. diameter at a distance of 40 cm. from target to port surface. The minute output of this beam is 25 r.

The circular 2.5-cm. cone is directed to the eye through the eyelid, and 75 or 100 r are delivered thus at each treatment. Treatments are repeated once a week until four have been given in one series. We then prefer to wait approximately six weeks before giving further treatment. We have repeated this course of irradiation (75 r four times weekly) as often as six times in a single case at intervals of two to four months over an elapsed time of two years (*viz.*, Case 26). In hemorrhagic glaucoma we use the same factors, the only difference being that we treat the eye every other day.

We have not used the larger doses advocated by Guyton and Reese in treating these conditions. While it is possible that larger amounts of radiation may be of some advantage in cases of diabetic retinosis, we find it difficult to expect survival of the physiological function of an eye receiving these rather massive doses.

CASES STUDIED

The cases of vitreous hemorrhage upon which this report is based have been con-

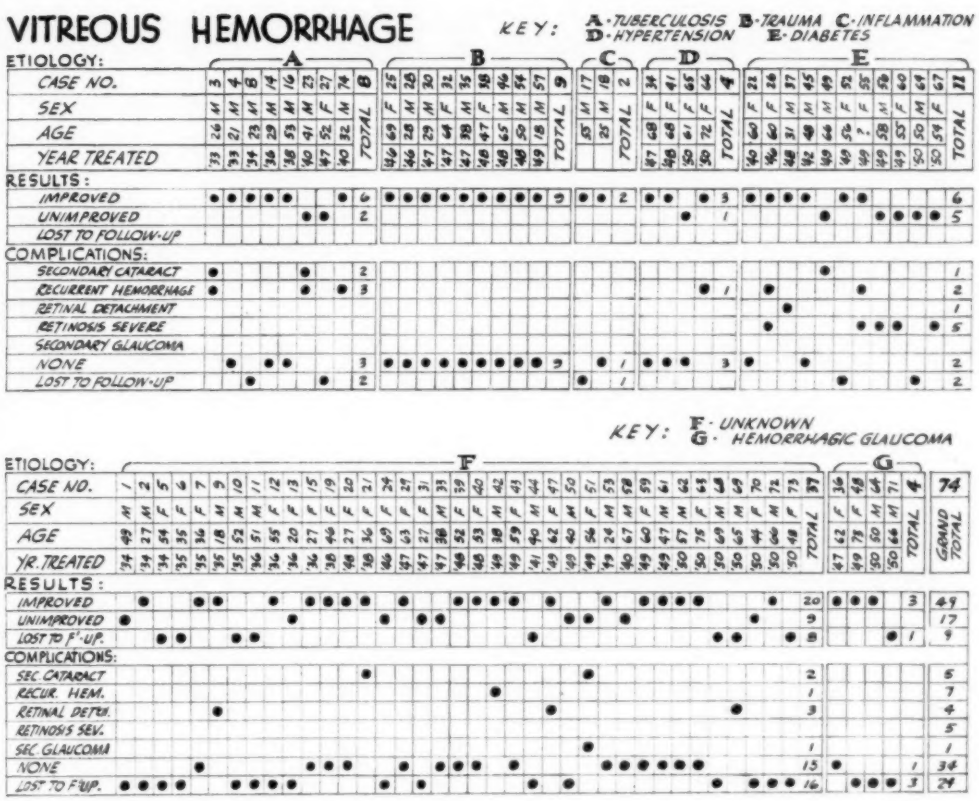

TABLE I

sidered to be due to tuberculosis in 8 cases, trauma in 9 cases, inflammation of the choroid and uvea in 2 cases, hypertension in 4 cases, diabetes in 11 cases, and to unspecified or unknown causes in 37 cases (Table I). Hemorrhagic glaucoma, as mentioned above, appears 4 times. Seventy-four cases in all have been studied. The discrepancy of one case is explained by the fact that in Case 64 both diabetes and hemorrhagic glaucoma existed and were treated separately.

RESULTS

A true and completely accurate estimation of results on the basis of a single factor was found not to be completely informative in reporting the effectiveness of treatment. We have therefore attempted to arrive at the result in each case by combining several criteria. We have taken as one criterion subjective improvement reported by the patient, either improvement of vision or, in some cases, relief of pain and discomfort. Objective evidence of improved visual acuity or absorption of blood clot has also been used as a criterion. On occasion it was found that, although subjective improvement in vision was not obtained, the objective findings were so definite that the therapy was thought probably to have prevented complications such as severe retinosis, hemorrhagic glaucoma, or secondary cataract. Such cases, therefore, were reported as improved. In the condition of hemorrhagic glaucoma, relief of pain has constituted the criterion of improvement.

Where the subjective findings were at variance with the objective impression of the ophthalmoscopist, improvement was considered to have occurred only when the

objective findings were without doubt and the ophthalmologist was of the opinion that sequelae were most probably prevented by the therapy.

On the basis of these multiple criteria, we have reported "improvement" in most of the cases treated (65 per cent); "no improvement" was reported in only 22 per cent, while 13 per cent were lost to follow-up before a satisfactory impression of the result could be determined.

It is to be noted that all the patients with traumatic hemorrhage (Table I, B), hemorrhage due to inflammation of the choroid and uvea (Table I, C); and hemorrhagic glaucoma (except for 1 patient lost to follow-up) (Table I, G) showed improvement by our criteria and none appear in the unimproved list.

In those cases in which the etiology was considered to be tuberculous (Table I, A), improvement was obtained in 6, while 2 patients were unimproved. Three cases due to hypertension showed improvement, while in 1 there was no improvement (Table I, D). In cases in which diabetes was the etiologic factor, results were less satisfactory: 6 patients were improved while 5 were unimproved.

The unknown or unspecified group, consisting of 37 cases, showed 20 improved, 9 unimproved, and 8 lost to follow-up before an estimation of the result could be made (Table I, F). We feel it necessary to remark, in defense of the cases which were lost to follow-up before satisfactory evaluation of the result, that the series is made up wholly of private patients treated in the offices of the ophthalmologist and referred to the office practice of the radiologists for therapy. Only a few were of a charity status. In this situation, though no charges are made for follow-up visits, patients seem not to realize this and, when subjective improvement has resulted early, they consider it unnecessary to reappear in spite of a system of reminders of missed appointments. Unimproved cases are, of course, also lost to follow-up but we feel that this occurs later and reflects itself mostly in the group in which sequelae or complications could not be determined. Loss to follow-up, we believe, is less likely to occur early in the course of observation if the patient is unimproved.

COMPLICATIONS

Listing the cases according to etiology (Table I), it becomes apparent that complications were less frequent in the conditions which showed the greatest percentage of improvement.

In cases due to trauma and to inflammation of the choroid and uvea (Table I, B and C), no complications were found. In hemorrhagic glaucoma (Table I, G), although 1 case was lost early and 3 late, it may be stated that in no case was enucleation or other surgery found necessary.

The tuberculosis group (Table I, A) showed complications of secondary cataract twice, recurrent hemorrhage three times, and no complications three times, while 2 patients could not be followed.

In the hypertensive cases (Table I, D) recurrent hemorrhage occurred once. The highest percentage of complications was in the diabetics (Table I, E), namely, secondary cataract once, recurrent hemorrhage twice, retinal detachment once, severe retinosis five times. In only 2 cases were there no complications, while 2 were lost to follow-up.

In the heterogeneous unknown category (Table I, F), complications occurred as follows: secondary cataract twice, recurrent hemorrhage once, retinal detachment three times, secondary glaucoma once. Fifteen of these cases showed no complications, and 16 were lost to follow-up.

We have not listed Eales' disease, as such in our estimate of causes of vitreous hemorrhages. This condition is characterized, as previously stated, by vitreous hemorrhages occurring in younger individuals, mostly between the ages of twenty and forty and more frequently in males; it produces as a diagnostic characteristic recurring hemorrhages followed many times by retinosis, secondary

cataract, and detachment of the retina. In our group of cases of unknown etiology, retinal detachment occurred once in a male of eighteen years (Case 9), secondary cataract once in a female of thirty-six (Case 21), and recurrent hemorrhage once in a male of thirty-eight (Case 42). There was no secondary glaucoma in patients between the ages of twenty and forty. Fourteen patients between eighteen and forty years of age are listed; 7 were males and 7 females. We feel that there is a great likelihood that Eales' disease was present several times in our series of cases, and by deduction we feel that our results reflect a high probability that this condition is greatly benefited by roentgen therapy, with prevention of recurrence of the hemorrhage and also of the rather disastrous complications.

CONCLUSIONS

(1) Roentgen therapy for vitreous hemorrhage is beneficial, hastening the absorption of blood clots and improving visual acuity.

(2) Except in vitreous hemorrhage due to diabetic retinitis, x-ray therapy decreases the development of complications and sequelae such as retinal detachment, secondary glaucoma, and severe retinosis.

(3) In hemorrhagic glaucoma, roentgen therapy prevents the need for enucleation and other surgical procedures.

(4) In traumatic hemorrhage into the vitreous, whether due to injury or following operative procedures, roentgen therapy is a very efficacious method of treatment, both in absorbing the blood clot and preventing sequelae.

(5) In diabetic retinosis little effect can be expected on the vascular component of the retina; however, absorption of the recurring hemorrhages will be hastened.

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SUMARIO

La Roentgenoterapia en la Hemorragia del Vítreo y el Glaucoma Hemorrágico

Setenta y cuatro casos de hemorragia del vítreo, incluso 4 de glaucoma hemorrágico, fueron tratados en los años 1933–51. Conforme al factor etiológico, corresponden los mismos a seis grupos: (1) tuberculosis; (2) traumatismo; (3) estados inflamatorios de la coroides y la úvea; (4) enfermedades hipertensivas; (5) diabetes; (6) desconocido.

El tratamiento se suministra a 200 kv. y 15 ma., con filtración por 0.2 mm. de estaño más 0.25 mm. de cobre, más 1.0 mm. de aluminio. Con un cono circular de 2.5 cm. de diámetro a una distancia de 40 cm., se administran 75 a 100 r a través del párpado una vez semanal durante cuatro semanas. Puede repetirse esa serie, pero hay que dejar transcurrir un plazo de seis semanas entre tratamientos.

Obtúvose mejoría en 65 por ciento de los casos de los AA.; 22 por ciento no revelaron mejoría; y se perdió de vista a 13 por ciento.

Dedúcese que: (1) La roentgenoterapia resulta beneficiosa en la hemorragia del vítreo, acelerando la absorción de los coágulos sanguíneos y mejorando la agudeza visual. (2) Excepto en la hemorragia del vítreo debida a retinitis diabética, la roentgenoterapia disminuye la aparición de complicaciones y secuelas, tales como desprendimiento de la retina, glaucoma secundario y retinosis grave. (3) En el glaucoma hemorrágico, la roentgenoterapia evita la necesidad de la enucleación y otros procedimientos quirúrgicos. (4) En la hemorragia traumática en el vítreo, ya debida a lesión o consecutiva a procedimientos operatorios, la roentgenoterapia constituye un eficacísimo método terapéutico, tanto en la absorción del coágulo sanguíneo cuanto en la prevención de secuelas. (5) En la rentinosis diabética, cabe esperar poco efecto sobre el componente vascular de la retina; pero sí se acelerará la absorción de las hemorragias recurrentes.

Extraperitoneal Pneumography[1]

HOWARD L. STEINBACH, M.D., RICHARDS P. LYON, M.D.,
DONALD R. SMITH, M.D., and EARL R. MILLER, M.D.

San Francisco, Calif.

THIS PAPER IS a progress report on a technic that has proved to be a useful adjunct in the examination of the extraperitoneal tissue and the organs which lie within it. "Extraperitoneal pneumography" is the term used to describe a procedure in which gas is injected into the extraperitoneal areolar tissue as a contrast medium to demonstrate roentgenologically the viscera which it surrounds (10). This procedure has been called "retropneumoperitoneum" by European investigators, but the name "extraperitoneal pneumography" appears to be preferable, since, in the first place, it indicates a diagnostic procedure and, in the second place, organs such as the liver and spleen, which are not retroperitoneal, may be examined by this means.

Carelli (3, 4) demonstrated in 1921 that CO_2 introduced into the renal fascia outlined the kidney, kidney capsule, and adrenals. Cahill (2) reported in 1935 that he was able to determine the presence of hypertrophy and tumors of the adrenal by this means. He also studied the adrenals in some patients with Addison's disease. Bariani (1) noted that, in the performance of a pneumoperitoneum, there was sometimes an accidental diffusion of air between the parietal peritoneum and the transverse fascia which outlined the contour of the posterior abdominal viscera remarkably well. Ruiz Rivas (7) was the first to utilize a generalized extraperitoneal emphysema for diagnostic purposes. He showed that through a single puncture into the retrorectal areolar tissue a diffuse and extensive emphysema could be produced in the cellular tissue of the entire body. By this means the posterior abdominal viscera were better outlined roentgenographically than with any previously used method.

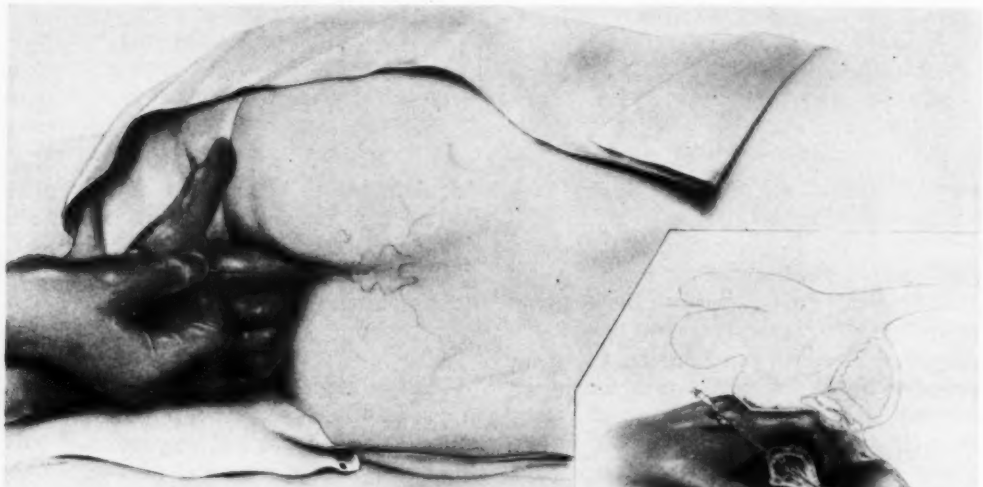
ANATOMY

The anatomy of the extraperitoneal tissue has been extensively described by Ruiz Rivas (8) and will be presented only briefly in this report. Between the fascia which covers the inner surfaces of the abdominal muscles and the peritoneum lies a considerable amount of extraperitoneal areolar tissue containing fat. This is part of an extensive layer which lines all of the body cavities outside of the various serous sacs, and it is continued on the vessels, nerves, and other structures which pass from the trunk into the limbs.

In the abdomen the extraperitoneal tissue is divisible into a parietal and a visceral portion. The former lines the walls, while the latter passes between layers of the peritoneal folds to the viscera. The parietal portion is thin and comparatively free from fat over the roof and anterior wall of the abdomen. In the pelvis this tissue is loose and fatty, and continues up for some distance on the anterior abdominal wall, thus permitting ascent of the distended bladder. In the posterior wall the tissue is abundant in amount and fatty, particularly where it surrounds the great vessels and kidneys. The visceral portions extend from the parietal portion along the branches of the aorta. The extensions are connected with the areolar coats of the blood vessels and pass with

[1] From the Division of Radiology and the Subdivision of Urology, University of California School of Medicine, San Francisco. Supported in part by an American Cancer Society Institutional Research Grant. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

Some of the patients included in this study were provided through the co-operation of the Laboratory of Experimental Oncology of the University of California School of Medicine and the National Cancer Institute (U.S.P.H.)



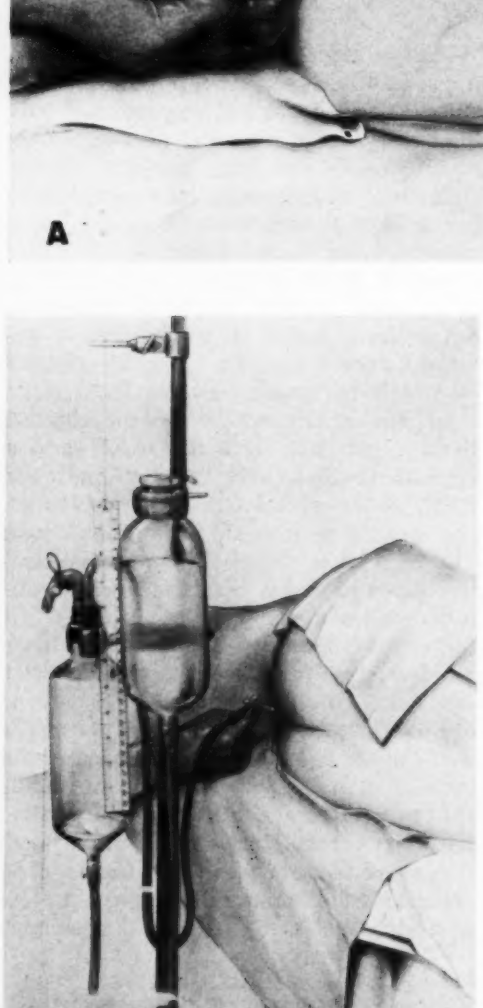


Fig. 1. A. The spinal needle is first inserted until the tip impinges upon the tip of the coccyx. The index finger of the opposite hand is placed in the rectum and the needle is redirected so as to slide along the anterior surface of the coccyx and through the anococcygeal raphe.

B. The injection set-up is attached to the needle through a sterile section of rubber tubing and a cotton filter. Oxygen is allowed to flow in at a pressure of 15 to 20 cm. of water.

them into the mesenteries and other folds of the peritoneum, thus reaching the viscera.

The chief functions of the extraperitoneal tissue are: (*a*) to unite the peritoneum to the fascial and muscular layers of the abdominal wall, and (*b*) to connect the viscera to the wall and to one another so loosely that there will be no interference with their distention or relaxation. In addition, the tissue is a storehouse of fat; it forms sheaths for the vessels and nerves and establishes, through a vascular plexus, communication between the parietal vessels and those distributed to the abdominal viscera.

TECHNIC

We have used a procedure which has produced satisfactory roentgenographic

outlines of some of the retroperitoneal organs without causing great discomfort to the patient. The equipment includes a local anesthetic ointment, 0.5 per cent novocain solution, No. 18 or 19 spinal needle, No. 26 hypodermic needle, a 5-c.c. syringe, 2 Kelly bottles and rubber tubing connected to provide injection pressure as for pneumothorax, and a source of oxygen. Oxygen has been used as the contrast medium for several reasons: it is available on any anesthetic machine; its absorption rate, which lies between that of carbon dioxide and air, allows time for diffusion through the extraperitoneal tissues and for a satisfactory roentgen examination; it has only a limited tendency to cause serious embolism should a vascular channel be invaded.

In most persons the tip of the coccyx is easily palpable relatively high in the internatal cleft. The injection needle may then be most easily inserted with the patient on his right side with knees drawn

Fig. 2. Normal extraperitoneal pneumogram. The kidneys, adrenals, psoas muscles, and rectum are outlined by gas.

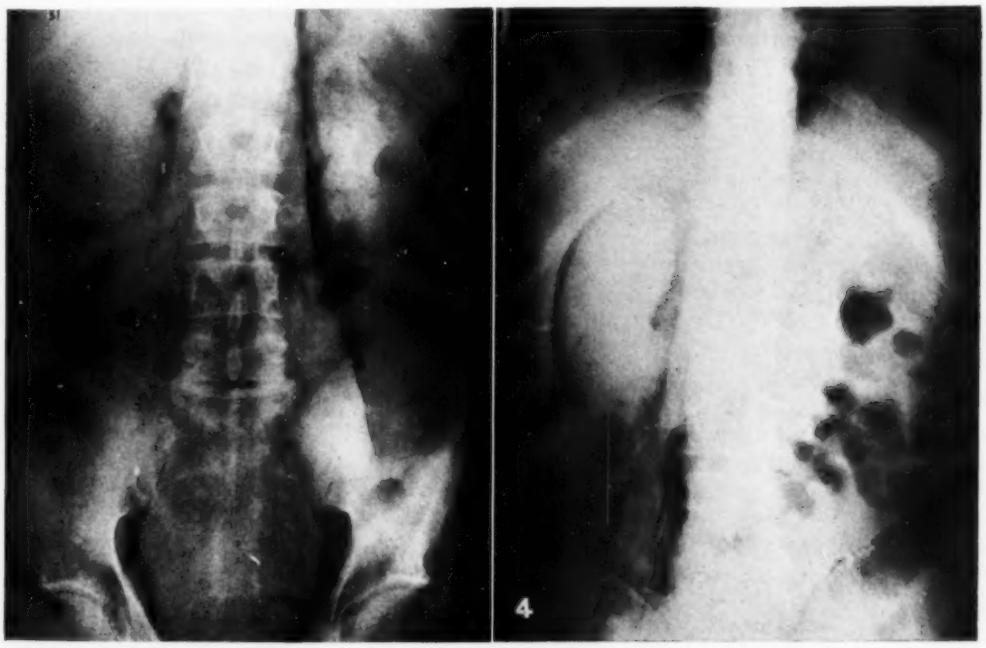


Fig. 3. The gas outlines the posterior abdominal viscera well on the left side, but poorly on the right side. The patient lay on his right side soon after the injection, so that the gas rose to the elevated left side.
Fig. 4. Same patient following injection of gas with the right side elevated.

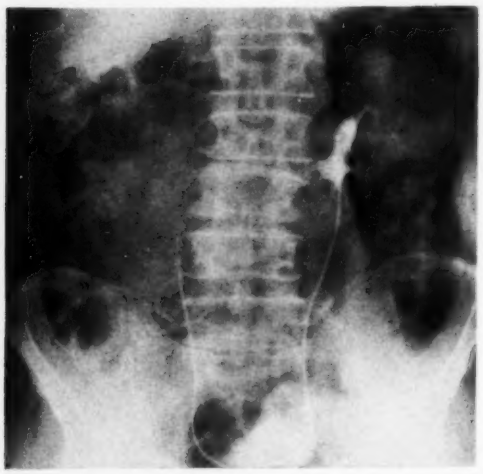


Fig. 5. Horseshoe kidneys. The left side was elevated during the injection of the gas so that only the left kidney is outlined. The rotation of the kidney along its vertical axis can be seen.

up. In the case of the obese patient with large buttocks, the coccyx lies deep in the internatal cleft and the lithotomy position has been found to be preferable.

The anus is anesthetized with anesthetic ointment, the injection site is prepared with antiseptic solution, and a skin wheal is raised with novocain in the midline between the anus and coccyx, 1 to 2 cm. from the latter. The spinal needle, with stylet removed so as to make any vascular intrusion obvious, is then inserted through the skin and subcutaneous tissue until the tip impinges upon the tip of the coccyx. The index finger of the free hand is placed in the rectum, and the needle is redirected so as to slide along the anterior surface of the coccyx and through the anococcygeal raphe. The needle is then inserted another 2 to 3 cm., always with the point as far posterior as possible to avoid perforating the fascia propria of the rectum (Fig. 1). The plunger of the syringe is withdrawn slightly to test for the perforation of a vessel and, if no blood is obtained, 2 or 3 c.c. of air are injected. If the air does not flow easily, moving the needle or ballotting the point with the rectal finger will usually produce adequate flow.

The injection set-up is attached to the needle through a sterile section of rubber tubing and a cotton filter. The oxygen is allowed to flow in at a pressure of 15 to 20 cm. of water. The extraperitoneal tissues have a positive pressure of about 10 cm. of water, so that a pressure greater than this must be utilized. If a pressure exceeding 20 cm. of water is required, the position of the needle is not correct and must be adjusted. The volume of oxygen to be injected varies with the size of the patient and the amount of extraperitoneal areolar tissue. At the present time, we are injecting 15 c.c. of gas per kilogram of body weight if both sides are to be shown, or one-half that quantity if only one side is to be demonstrated. This is about the amount that eventually produces some mild discomfort in the flanks.

During the insertion of the needle, a finger is placed in the rectum to keep the injector aware of the position of the needle point. If the rectum is perforated, or blood is withdrawn after the anococcygeal raphe is reached, the needle is withdrawn and the examination postponed for twenty-four hours. If a subcutaneous emphysema appears around the perineum, the needle has not been inserted far enough and still rests outside of the anococcygeal raphe. It must be inserted at least another 2 cm.

We have observed that the gas has a tendency to pass into the highest portion of the extraperitoneal tissue. Therefore, if an extraperitoneal pneumogram of a single side of the body is desired, the patient is placed in the lateral decubitus position with that side elevated. A unilateral pneumogram is preferred if the disease process is limited to one side, since the lateral film is easier to interpret, there is less gas in the mesentery and surrounding the bowel, and a smaller amount of gas is required. If a generalized extraperitoneal pneumogram is wanted, one-half the gas is injected with the right side elevated and the rest injected with the left side elevated. Previously we injected the entire amount with the patient prone (9)

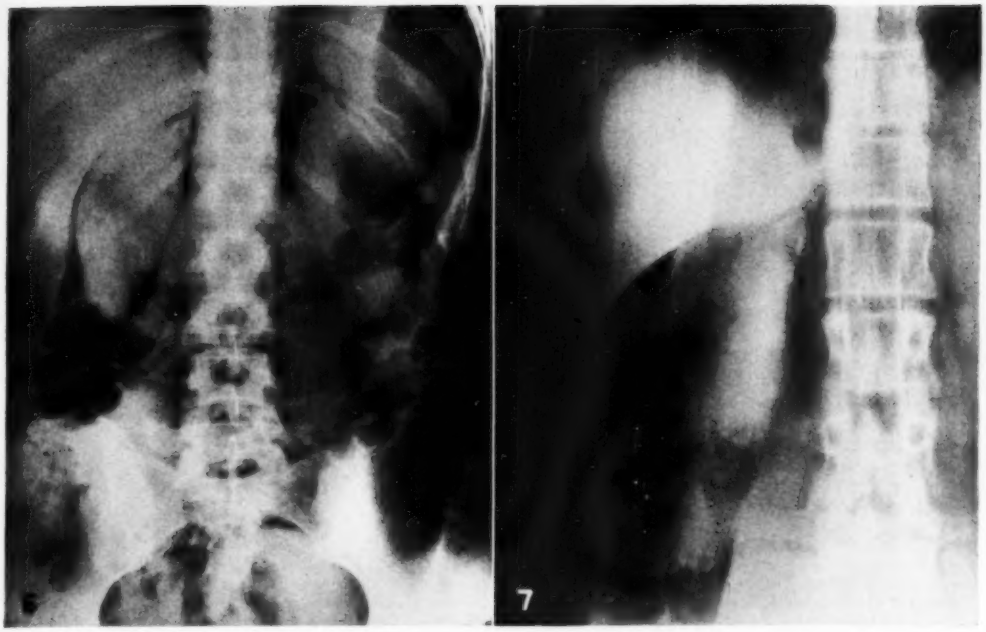


Fig. 6. Hydronephrosis and dilatation of the upper part of the left ureter due to compression by a metastatic mass. The patient had carcinoma of the cervix. The dilated kidney pelvis and upper part of the ureter on the left side can be seen medial to the kidney shadow.

Fig. 7. Hydronephrosis of the right kidney due to obstruction of the ureter in the pelvis by carcinoma of the uterine cervix. The tomogram demonstrates a huge lobulated kidney.

Fig. 8. Hypernephroma of the right kidney. The extraperitoneal space on the right side is occupied by a large, partially calcified mass. There is no gas in the extraperitoneal tissue on the right side because the areolar tissue is compressed by the large mass.

Fig. 9. A lateral view in the same patient demonstrates the left kidney well. The renal artery can be seen.

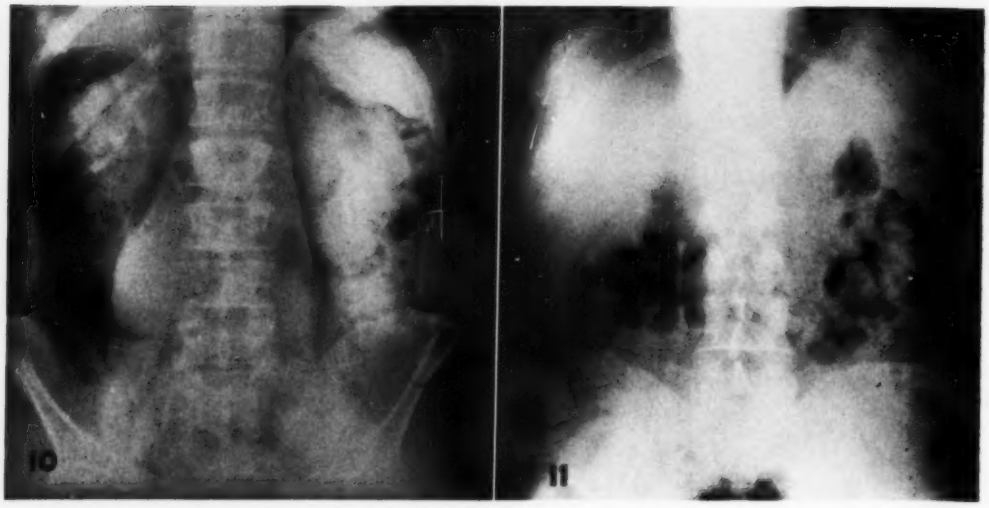


Fig. 10. Hypernephroma arising from the lower pole of the right kidney.
Fig. 11. Extensive diffuse lymphosarcoma involving the retroperitoneal structures. Oxygen was injected into the retrorectal areolar tissue on three separate occasions without diffusing into the retroperitoneal region.

Fig. 12. Retroperitoneal tumor on the left side diagnosed as lymphoid hyperplasia by the pathologist. There is an absence of gas in the retroperitoneal areolar tissue lateral to the left psoas muscle. This is due to compression of the extraperitoneal tissue by the tumor.

but found that in many instances the gas was not distributed uniformly.

There is a remarkable absence of discomfort. A sense of fullness in the region of the rectum usually is first noticed. After injection of 400 or 500 c.c. of gas, the patient may complain of a dull flank ache. In no case has this been severe enough to interfere with the examination.

Roentgenograms are obtained as soon as the injection has been completed. If these are not satisfactory, they are repeated after the gas has had sufficient time to diffuse throughout the extraperitoneal tissues. The optimum time for obtaining films varies from patient to patient, but in most persons appears to be about two hours after the injection has been completed. Since the gas has a tendency to rise to the highest part of the body, the patient is placed in a position with the part to be examined elevated while waiting for the roentgen examination to be conducted. Thus, if the posterior abdominal organs on both sides of the body are to be examined, the prone position is indicated. If roentgenograms of the organs on one side are desired, that side is kept elevated. Roentgenograms are then produced with the patient so positioned that the part to be examined is closest to the film cassette.

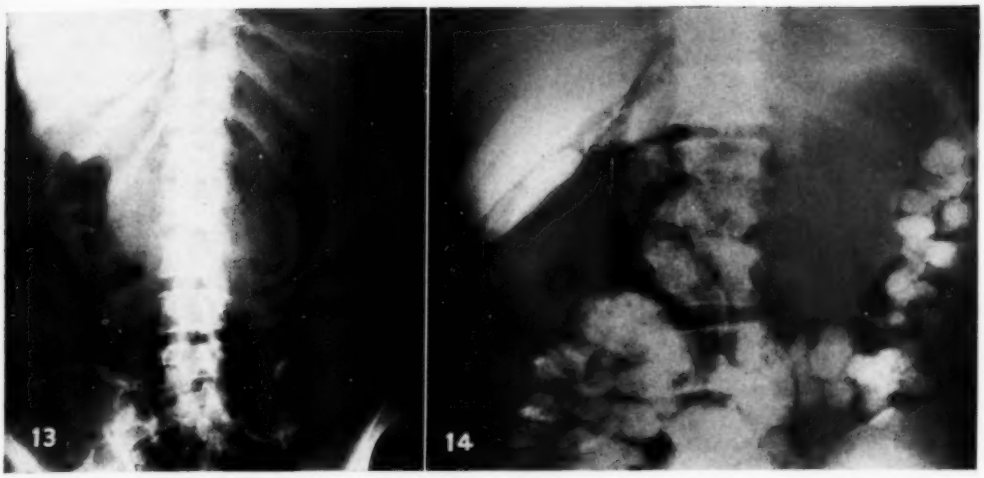


Fig. 13. Left adrenal cortical tumor displacing the kidney downward.
Fig. 14. Charcot joint with destruction of the adjacent surfaces of the first and second lumbar vertebral bodies. A paravertebral mass can be seen displacing the right kidney laterally.

Stereoscopic films have been helpful in localizing the subserous emphysema and differentiating it from the shadows produced by gas in the lumen of the gastro-intestinal tract. We have found tomography to be particularly useful, in that it eliminates the confusing shadows caused by gas in the gastro-intestinal tract and anterior abdominal wall. In some cases, structures are visible on tomograms that on plain roentgenograms are obscured by overlying gas.

DISCUSSION

Ruiz Rivas chose to inject the gas into the retrorectal areolar tissue because of its accessibility, its proximity to the extra-peritoneal tissue of the posterior abdomen, and because of the absence of large blood vessels and vital viscera in this region. As the gas is injected, it surrounds the rectum and extends into the cellular tissue of the parametrium which envelops the fallopian tubes and ovaries. It passes upward along the psoas muscles, mid-abdominal vessels, kidneys, spleen, and attachments of the diaphragm. The kidneys have their own closely adherent capsule, around which is Gerota's sheath or capsule. This surrounds not only the kidney but the adrenal gland and a considerable amount of neighboring fat in the form of a loose sheath in which anterior and posterior walls may be distinguished. It is open inferiorly and medially, but closed above and lateral to the kidney by the apposition of its walls. The injected gas passes around Gerota's fascia and also extends through the inferior opening to outline the kidneys and adrenals. Some of the gas passes along the vessels into the mesentery and cellular tissue between the visceral peritoneum and wall of the stomach and bowel. If enough gas is injected, it will rise into the extrapleural and mediastinal connective tissue through the apertures formed by the fibrous insertions of the diaphragm to the skeleton, and through the areolar tissue surrounding the great vessels and esophagus. The gas then passes into the areolar tissue of the neck.

The most important organs outlined by the gas are those in the pelvis and posterior abdomen. The gas injected into the retrorectal space demonstrates the uterus, the tubes, ovaries, and bladder, but these structures are partially obscured by gas surrounding the rectum and in the anterior abdominal wall. It has been found that

Fig. 15. Wilson's disease (hepatolenticular degeneration). The liver appears small.

gas may be injected directly into the cellular tissue of the parametrium through the vagina, thus outlining only those organs. The psoas muscles are sharply defined. The external contours of the kidneys and adrenals stand out in contrast to the gas within Gerota's fascia. Frequently the gas does not penetrate the cellular tissue between the adrenal gland and the kidney, so that the two organs will appear as a single shadow. In our experience the left adrenal gland has been outlined more often than the right gland. There isa difference in form of the two adrenal glands due to the molding of adjacent structures. The right gland is triangular; the left is semilunar and extends further down the medial side of the kidney than the right one. The margins of the spleen and liver are easily identified by the presence of the gas between them and the peritoneum.

We have been disappointed, as have the European investigators, in being unable to demonstrate the pancreas. This probably is due to the small amount of areolar tissue between the anterior surface of that organ and the peritoneum. We have examined three patients with carcinoma of the head of the pancreas, one with carcinoma of the head and body, and one with a diffusely enlarged pancreas due to pancreatitis, without being able to identify on the roentgenograms any encroachment upon the extraperitoneal tissue by the enlarged organ.

Extraperitoneal pneumography has been employed by us in the examination of 60 patients. One patient was examined three times within a period of four weeks. There have been no complications of any type. Only one patient complained of more than mild discomfort, a woman who experienced some back pain prior to the examination. This appeared to increase after the gas was injected. Ten of our series were outpatients and were allowed to return home on completion of the examination. One patient who had a paroxysmal tachycardia following a coronary occlusion suffered no ill effect from the procedure.

Fig. 16. Diffuse calcification of the pancreas. The pancreas was enlarged but was not outlined by the retroperitoneal gas. The arrows point to the pancreatic calcification.

Theoretically the possibility of producing a pulmonary gas embolism exists. The use

of perirenal insufflation has been abandoned in many institutions because of the frequency with which air embolism occurs during this procedure. With injection of gas in the retrorectal tissues, which have no large vessels, under controlled pressure of only 20 cm. of water, the possibility of this accident has been greatly reduced. Durant (6) has shown that in dogs the factors which were most closely related to mortality in experimental production of pulmonary gas emboli were: the amount of air injected, the speed of injection, the effectiveness of the pulmonary excretory mechanism, and the position of the animal. He found that an animal can tolerate more air when lying on its left side than in any other position. Furthermore, if an animal showed evidence of marked right ventricular failure while lying on its back and was then turned onto the left side, recovery frequently followed immediately. Death, when it occurred, was due to circulatory obstruction resulting from an air trap in the right ventricular outflow tract. Displacement of the air trap by turning the body into the left lateral position may be life-saving even after the right ventricular contractions have become feeble. This principle would also apply in man, and one should be prepared to place the patient on his left side in the event of an air embolism.

Extraperitoneal pneumography appears to have its greatest practical application in demonstrating diseases of the kidneys and adrenal glands. The disease process may manifest itself as a change in the contour or size of the organ. A small neoplasm may be completely outlined by gas and its relationship to adjacent structures determined. A more extensive neoplasm may infiltrate or compress the areolar tissue so that its presence may be suspected in the absence of gas in a region which would normally contain it. Before definitely ascribing the absence of gas to a disease process, however, one must be sure that the technic was correct. The injection should be repeated if any doubt exists.

Extraperitoneal pneumography appears to be a valuable method for examining the extraperitoneal abdominal and pelvic viscera for the following reasons:

1. It is simple. The needle is inserted into the cellular tissue between the rectum and sacrum, which is relatively easy to do.
2. It appears to be safe. There are no large vessels in the retrorectal space, thus reducing the possibility of air embolus. We have injected into dogs, without harmful effects, as much as 160 c.c. of oxygen per kilogram of body weight, which is over ten times the dose advocated for patients, and under pressures as high as 160 c.c. of water.
3. The injection is not painful.
4. Only one puncture is necessary to demonstrate both sides.

SUMMARY

Extraperitoneal pneumography is a procedure in which a gas is injected into the extraperitoneal areolar tissue to demonstrate roentgenologically the posterior abdominal and pelvic viscera. The gas is injected into the areolar tissue between the rectum and sacrum, from which it extends into the cellular tissue of the entire body. Roentgenograms will demonstrate the uterus, uterine tubes, ovaries, kidneys, bladder, adrenals, liver, and spleen. With injection of a large quantity of gas, the structures in the mediastinum and neck may be outlined. A unilateral emphysema can be produced by introducing the gas with the patient in a lateral decubitus position.

NOTE: Since this paper was written, Dr. Ruiz Rivas has informed us that Dr L. P. Mosca has collected a series of 1,500 cases of extraperitoneal pneumography, including 220 of his own. These procedures were all done without any fatal complications.

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SUMARIO

Neumografía Extraperitoneal

La neumografía extraperitoneal, o sea el "retroneumoperitoneo" de los europeos, es un procedimiento en el que se inyecta gas en el tejido areolar extraperitoneal para la observación roentgenológica de las vísceras posteriores del abdomen y de la pelvis. La inyección se ejecuta en el tejido areolar entre el recto y el sacro, de donde se extiende al tejido celular de todo el cuerpo.

Las radiografías tomadas después de la introducción del gas revelarán el útero, las trompas uterinas, los ovarios, los riñones la vejiga, las suprarrenales, el hígado y el bazo. Inyectando una gran cantidad de gas, pueden demarcarse los tejidos del mediastino y del cuello. Cabe producir un enfisema unilateral verificando la inyección con el enfermo en decúbito lateral.

La neumografía extraperitoneal parece encontrar su mayor applicación práctica en el descubrimiento de las enfermedades de los riñones y las adrenales. El proceso patológico puede traducirse por una alteración del contorno o tamaño del órgano. Una neoplasia puede quedar totalmente demarcada por el gas, pudiéndose así determinar la relación de la misma con los tejidos adyacentes. Una neoplasia más extensa puede infiltrar o comprimir los tejidos areolares, de modo que cabe sospechar su presencia de no haber gas en una región que lo contendría normalmente.

El método es sencillo e inocuo.

DISCUSSION

Samuel Brown, M.D. (Cincinnati, Ohio): Listening to Dr. Steinbach's paper I am reminded of a patient in whom, following a contrast enema, air was found not in the bowels but in the retroperitoneal spaces (see Radiology **37:** 228, 1944). I was quite puzzled to explain the occurrence of the air outside of the bowel, for no sign of an injury was discovered in the rectum upon examination. Neither did I then appreciate the value of such an accidental discovery. Now I can see that it may prove to be useful in some patients in whom retroperitoneal air injection is indicated.

Some Obscure Factors in the Production of Unusual Small Bowel Patterns[1]

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THE EFFECT OF the various emotions on the intestinal tract is extraordinarily well known in folklore and in literature, having been recognized over a long period of time. This knowledge is reflected in poetry, fable, and vulgar sayings and is as familiar to the man in the street as to the student of the classics. Examples vary from the lament of the unnamed woman in the *Song of Solomon*, who cried: "And my bowels yearn for him," to the vulgar but pithy expression indicating the very ultimate of fright; from the familiar Army admonition, "Don't get your bowels in an uproar," to the wise observation of Aesop, who two thousand five hundred years ago wrote: "And the wolf defecated thrice for the great fear that he had."

In view of this widespread and common knowledge, knowledge widespread in time and in place, it is amazing that we physicians pay so little attention to emotion and emotional conflicts as a likely source of much of the abnormal gastro-intestinal behavior that confronts us.

Vomiting, pain, and diarrhea are frequent complaints. They arise from many causes, ranging from the ingestion of some noxious substance to a malignant tumor. As radiologists, we are not often confronted with patients whose complaints are due to a plain hangover or to acute food poisoning; the mechanism here is usually quite obvious, and the syndrome is of short duration and self-limited. Vomiting due to pyloric obstruction and the pain and vomiting of intestinal obstruction offer no great problem. Other objective findings and the history will usually afford a clue sufficient for solution of the problem. I do not pretend to have disposed of the organic causes of vomiting, pain, and diarrhea; I mention only these two simple examples to indicate that, ordinarily, there should be no great difficulty in the recognition of actual organic causes for these symptoms.

But not infrequently we are faced with a diagnostic problem of a quite different nature, as, for example, that of a patient who has been vomiting for two or three years with no weight loss and with no very appreciable change in health, or a patient with a long history of abdominal pain and diarrhea, unaccompanied by much perceptible harm. If one asks oneself what organic disease produces vomiting or diarrhea and abdominal pain, continuing several years with little change in the general status of the patient, he will find it difficult to answer. Yet such cases are not infrequently encountered and are tagged with such labels as "spastic colitis," "duodenal stasis," and the like.

Assuming that we are able either to find or to exclude organic disease in some cases, we are left with a larger number of patients in whom no organic cause for the gastro-intestinal disturbance has been discovered. We must then consider the possibility that the condition is of psychic origin. Certainly, the identification of psychic lesions is not a function of the radiologist, nor is there any manifestation or group of manifestations which will lead to the recognition of such conditions. In general, our part is to establish, or to eliminate, the possibility of organic disease. Nevertheless, we may occasionally be able to suspect an emotional disturbance or an unconscious conflict if we bear in mind that they are frequent and

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

Figure 1. Case I. Three hours after ingestion of barium and salt solution.

Figure 2. Case I. Three hours after ingestion of barium solution and pork. The patient was unaware of the addition of the pork.

that often they lead to disturbances of the gastro-intestinal tract.

With these few observations, I should like to present a case of profound emotional conflict which actually was deduced from examination of the gastro-intestinal tract.

CASE I: A white woman, 54 years old—and it is essential to her history that she is Jewish—entered the hospital for diagnostic study, complaining of vomiting, abdominal pain, and diarrhea extending over a period of twenty-two years. During this time she had undergone fifteen abdominal operations, with no relief of symptoms. Her past history otherwise seemed of little significance. She did not appear to be acutely ill. She had not suffered any appreciable loss of weight over the past few years. Except for heavy scarring of the abdominal wall, there were no physical findings of importance. General nutrition was reasonably good.

Shortly after admission a gastro-intestinal x-ray investigation, including survey films of the small intestine, was made. The opaque medium employed was an allergen-free suspension of barium sulfate in normal salt solution. No organic lesion was observed and the pattern and behavior of the intestinal tract were not remarkable (Fig. 1). During this study, the examiner talked freely with the patient and was rather astonished when she told him that she knew what her trouble was but that no one would listen to her. Assured that he would listen, she said flatly that she was allergic, and that the substance to which she was allergic was pork.

This seemed to be a significant statement. Jewish dietary laws are extremely complicated and involve a great deal more than simply not eating pork. I believe it a fair statement, nevertheless, that pork is a sort of prime symbol, and that many quite devout Jews would overlook some of the minutiae of the law and would still refuse to eat pork. With this in mind, the possibility occurred to us that this woman, an educated and cultured person who believed herself to be an agnostic, and who paid no regard to the dietary laws of her religion, was suffering from an unconscious conflict which, when she ate pork, manifested itself as an emotional storm passing over the sympathetic chain, producing a marked and dramatic effect in the gastro-intestinal system.

The patient was told that it would be necessary to repeat the gastro-intestinal study and on the second occasion she was given a different opaque medium. The bone was removed from a pork chop and the meat was carefully stripped of all fat and thoroughly cooked in a pressure cooker. It was then ground very finely and, with a high-speed blender, was mixed with barium sulfate and normal salt solution. The patient was quite unaware of any difference between this mixture and the opaque

medium employed in the first examination, and took it without comment. The findings were identical with those previously observed and were believed to be of no significance (Fig. 2).

The fact that the patient had ingested a considerable amount of pork with no evidence of any reaction, and with no change in the behavior of the gastro-intestinal tract, was thought to eliminate this as a possible source of allergens.

No difficulty was experienced in persuading the patient to submit to a third examination, and this was carried out with the opaque medium employed for the first study, *i.e.*, barium sulfate in normal salt solution. Immediately after the suspension had been taken, she was offered a small slice of well done roast pork, from which all fat had been removed. Within thirty minutes after eating the meat she experienced violent abdominal pain and a film of the abdomen showed a striking change in the pattern of the small bowel (Fig. 3).

Figure 3. Case I. Three hours after ingestion of barium and salt solution and the conscious eating of pork.

Here, then, is an objective demonstration of a psychic lesion—an emotional storm resulting from an unrecognized conflict in the unconscious. This is not the sort of thing that permits one to present a microscopic section as a final proof, but the patient made a complete recovery when she understood the nature of her conflict and ceased attempting to ignore consciously laws from which she could not escape unconsciously.

An emotion need not be unconscious, nor need it result in conflict, in order to produce alteration in the behavior and the pattern of the small intestine. Everyone knows the effect of terror on the intestinal tract and it is apparent to all of us that worry, dread of an event, and sorrow bring about changes in our digestive processes. The influence of conscious and easily recognized emotion is shown in the case presentation which follows.

CASE II: A white male, aged 56, was admitted to the hospital for what he termed "a thorough check-up." He was not ill and he presented no symptoms. His past history seemed unimportant. Physical examination, a complete blood count, determination of the sedimentation rate, urinalysis, blood sugar estimation, an electrocardiogram, excretory urography, chest films, and a gastro-intestinal survey revealed no significant findings. In fact, no organic lesion was found during the entire survey except a small prostatic adenoma which was producing no symptoms.

The patient was entirely unaware that his son was in Federal custody and on trial in a Federal court until the day on which sentence to a prison term of ten years was pronounced. On the following day an interested clinician, aware of the emotional effects described in the case recorded above, persuaded the patient to have a second gastro-intestinal study. The technics employed in the two examinations were identical, but the alteration in the appearance and behavior of the small bowel was striking. Whereas at the first examination it exhibited a quite usual appearance, on the second occasion there were observed marked hypomotility, almost complete disappearance of the mucosal folds, and segmentation of the bowel.

A second, and perhaps unrelated, cause for bizarre and puzzling alterations in the appearance and the function of the small intestine is the ingestion of allergens. Gastro-intestinal allergic reactions are probably of more frequent occurrence than is generally believed. The allergic response may involve the entire gastro-intestinal tract or may limit itself to one section, and will commonly produce abdominal pain, nausea and vomiting, and diarrhea. There need not necessarily be other allergic manifestations (although there may be), nor does a negative skin reaction to the

suspected substance eliminate the possibility of a gastro-intestinal response.

Not much is known as to the actual nature of the changes which occur in the intestine when allergens are ingested. According to Golden, there may be (*a*) edema, which may be localized to a small area, as in urticarial wheals; (*b*) spasm of smooth muscle; (*c*) inflammatory changes, as in eczema.

The roentgen findings are quite variable and can be definitely interpreted as representing an allergic response only as they occur, or are strikingly accentuated, when the suspected food is added to (or given in conjunction with) the usual allergen-free barium suspension. They consist, in general, in marked alteration in the motility of the gastro-intestinal tract, with narrowing and segmentation of the small bowel, through which the barium is scattered in an irregular and disconnected manner, producing a picture strikingly unlike that of the normal barium-filled small intestine. A rather large gastric retention is a frequent finding; in one instance we observed almost no emptying of the stomach four hours after the ingestion of the opaque medium.

The following cases are of interest because of the striking changes provoked by the allergen-bearing food, which was milk, and the prompt relief which was obtained following avoidance of the allergen in the first case.

CASE III: A white female, aged 29, had no significant history except for rather long-standing abdominal pain. About ten years previously she began to have what she described as a "generalized stomachache." After enduring this for three years, she had her appendix removed. There is no record of examination of the appendix by a pathologist, but the patient's symptoms were not relieved. For the ensuing four years, however, she was not very uncomfortable and received no medical treatment. About two years before the present study, she began to experience cramping epigastric pain with marked tenderness and vomiting. She was hospitalized and subjected to gastric analysis and to x-ray studies of the gallbladder and gastro-intestinal tract. The gastric acidity was normal, and the x-ray findings were not significant. The patient was nevertheless put on an ulcer regime and was given antispasmodics. She felt fairly well for a time, but alternating periods of diarrhea and constipation presently developed, with recurrent attacks of abdominal pain. The pain occurred one and one-half hours to two hours after meals, and was said to be most severe after breakfast.

By this time the patient had discovered that there were three things which increased the severity of the pain: ice cream, milk, and whisky. With this clue in mind, she was given an allergen-free suspension of barium sulfate in normal salt solution and a small bowel study was carried out. The intestinal pattern was definitely abnormal (Fig. 4), perhaps because the responsible allergens had been regularly in her diet. Four days later the examination was repeated and, on that occasion, some milk was added to the opaque medium without the patient's knowledge. Comparison of the two studies showed very striking differences (Fig. 5), and it was concluded that the symptoms were due to allergens in milk. The patient was given some crude liver extract intramuscularly and some yeast by mouth, and was instructed to boil all milk for ten minutes. Her symptoms disappeared and have recurred only once in the past three years; on that occasion she had eaten some ice cream.

Shortly after the experience just related another patient with a similar but much more severe syndrome was seen. There was no particular reason to suspect an allergic reaction, and the study was suggested almost entirely by our keen interest in the similar problem which we believed we had just solved.

CASE IV: A white female, aged 44, gave a long history, extending over twenty years or more, of severe abdominal pain and vomiting. Several exploratory abdominal operations had been performed, but no definite lesion was ever found. The patient was somewhat confused, and a clearly defined history was not obtained. Certainly she had had much pain over a long period. The gastro-intestinal tract was studied with the usual suspension of barium sulfate in normal salt solution and, a few days later, was re-examined with the addition of some milk to the medium. Although the small bowel was far from normal at the first examination (Fig. 6), the addition of milk produced remarkable alterations in both the appearance and the behavior of the intestine (Fig. 7).

It was impossible to alter the patient's dietary habits, and the findings remain inconclusive, but her symptoms and the x-ray manifestations so closely resemble those of the previous case that it seems likely that they are also of an allergic nature.

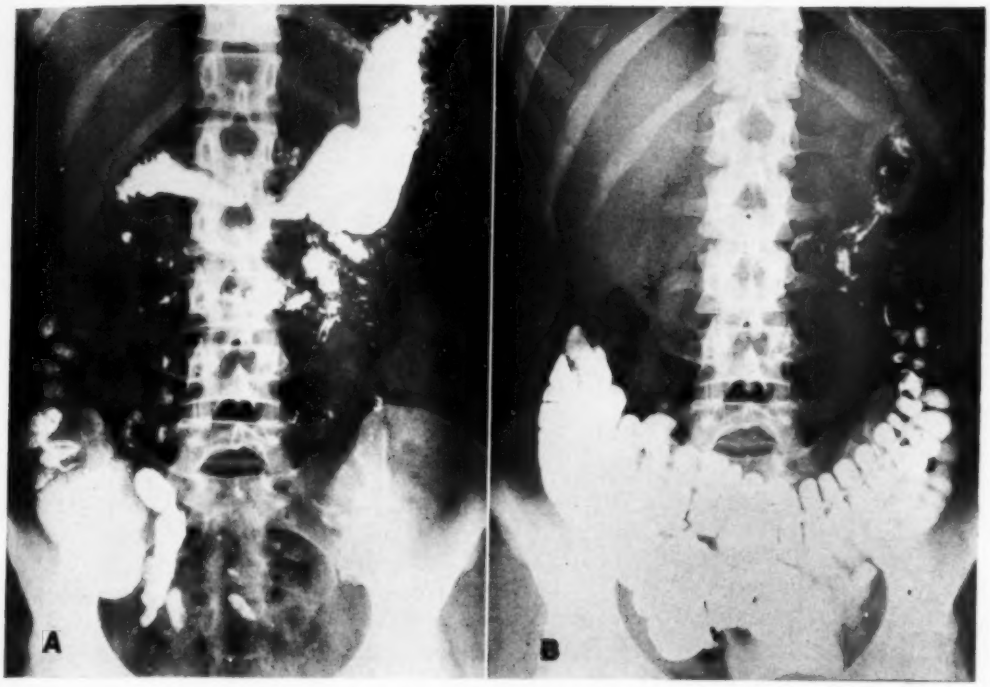

Figure 4. Case III. A. One hour after ingestion of barium and salt solution. B. Four hours after ingestion of barium and salt solution.

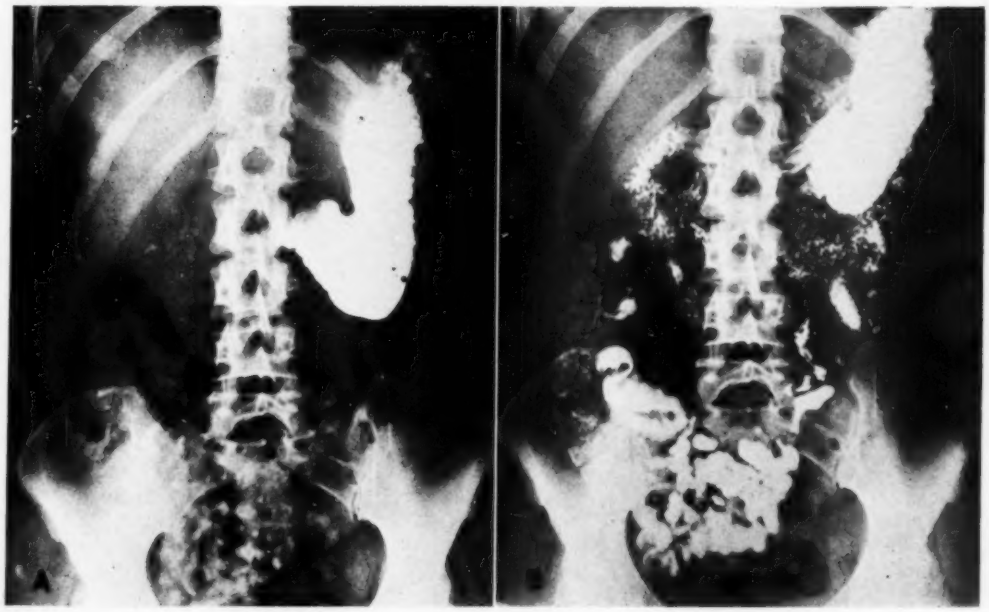

Figure 5. Case III. A. One hour after ingestion of barium, salt solution, and milk. B. Four hours after ingestion of barium, salt solution, and milk.

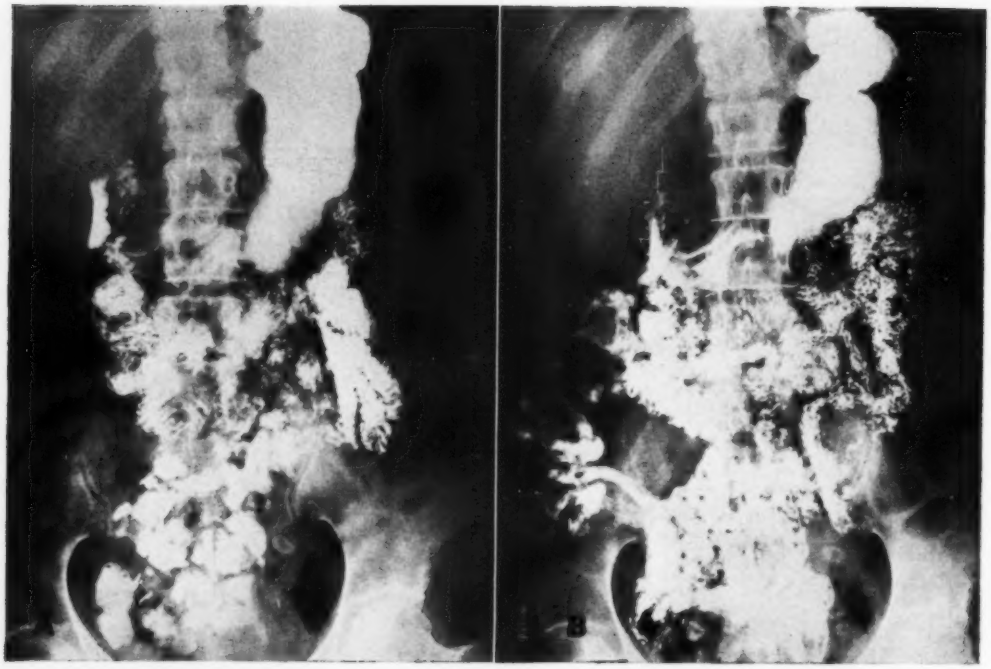

Figure 6. Case IV. A. One hour after ingestion of barium and salt solution. B. Two hours after ingestion of barium and salt solution.

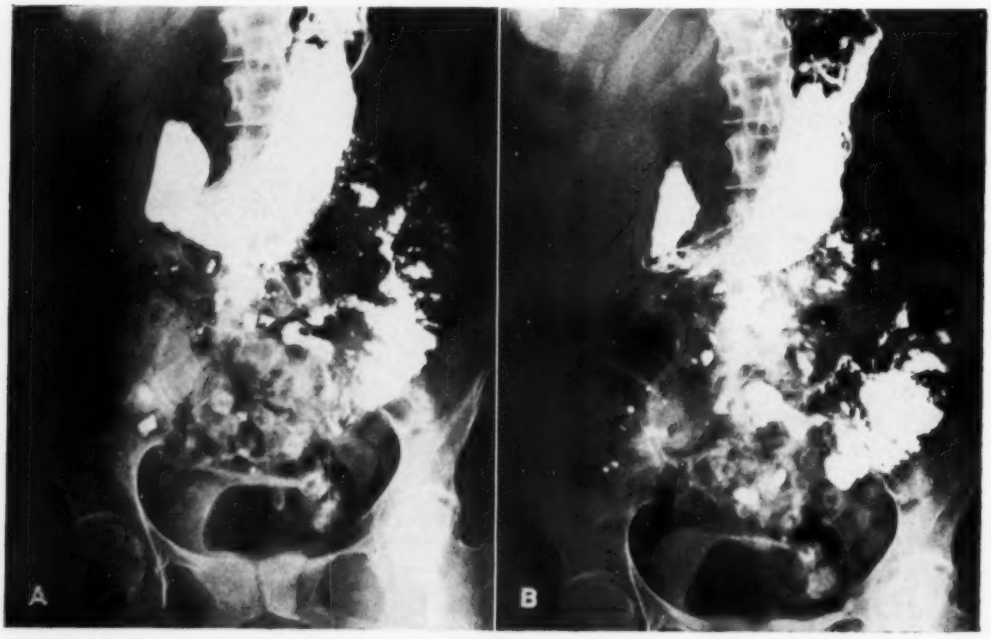

Figure 7. Case IV. A. One hour after ingestion of barium, salt solution, and milk. B. Two hours after ingestion of barium, salt solution, and milk.

SUMMARY

For some years past, we have become increasingly conscious of the small intestine and its diseases, and we now recognize, as a matter of routine, cicatrizing enteritis, ileocecal tuberculosis, tumors of the small bowel, and the manifestations of dietary deficiency. Our purpose in the present paper is to direct attention to the fact that there are other causes—perhaps many other causes—for alterations in the behavior of the intestinal tract and that these may be as far apart as psychological states and specific allergies.

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SUMARIO

Algunos Factores Obscuros en la Formación de Patrones Extraños del Intestino Delgado

Ordinarimente no hay mayor dificultad en el reconocimiento de lesiones orgánicas reales del intestino delgado, que ocasionan vómitos, dolor abdominal y diarrea. Sin embargo, bastantes veces otros factores constituyen la causa de dichos síntomas y de alteraciones del comportamiento del tubo intestinal, que pueden observarse roentgenológicamente. Preséntanse 4 casos de ese género: uno debido a profundo conflicto afectivo, que no reconoció el enfermo y fué deducido del examen radiológico, uno debido a un trastorno afectivo consciente y fácil de reconocer y dos que representaban reacciones alérgicas a la leche.

DISCUSSION

Earl E. Barth, M.D. (Chicago, Ill.): This most interesting paper constitutes still another valuable contribution to our knowledge of the small bowel with its not infrequent queer behavior. I am happy to open this discussion for several reasons, specifically to learn that bizarre small bowel patterns occur in California as well as in Chicago and that the interpretation of these peculiar patterns is also causing our colleagues no little trouble. Dr. Goin has opened the door on a phase of our work to which all of us might well pay more and more attention, *i.e.*, a logical correlation of the history, the clinical observations, and the roentgen findings. Not infrequently the patient will give the radiologist, if he takes time to listen to his or her story, a hint or information not gleaned by the referring physician, which may aid immeasurably in arriving at a definitive interpretation. Dr. Goin is to be congratulated for his shrewd and astute observations. Most of all, he has been truly a clinical radiologist and has evaluated the history in his interpretation of the roentgen findings.

Even though the small intestine is physiologically more important than the stomach or colon, this structure for many years was neglected, probably because of technical difficulties. Life can be maintained after resection of either the stomach or colon, but if too much of the small bowel is removed, adequate nutrition becomes a serious problem. Only in recent years, due in no small part to the work of Golden, physicians in general, but particularly roentgenologists, have been making a concerted effort to study the small bowel thoroughly, to acquaint themselves with the normal anatomical appearance and physiology and the roentgen findings associated with various maladies and disorders.

This paper emphasizes the importance of psychic factors and food allergy as etiologic factors in the production of unusual small bowel patterns. The influence upon the intestinal tract of emotional states, such as fear, anxiety, apprehension, waiting for the examination, and frustration, has been known for years, but objective and visual evidence of this effect is often demonstrated with much difficulty. In this respect Dr. Goin's second case report is most interesting.

In my experience, the effect of the ingestion of allergens on the appearance and functions of the small bowel has been difficult to evaluate. The roentgen findings I have found extremely variable and inconstant; frequently no abnormality is noted and often alterations of pattern and motility are not evident on subsequent examinations even though there has been no change in the patient's diet. Delayed emptying of the stomach presumably is a fairly frequent finding, at least in our experience. The observations of Dr. Goin are most interesting and instructive and I am sure will help all of us in evaluating some of these bizarre small bowel patterns.

Ross Golden, M.D. (New York, N. Y.): Ever since Dr. Goin sent me the films of his first case after he had demonstrated the interesting changes wh'ch

he has described, I have been urging him to put it in the literature.

He made a statement just as he concluded to the effect that allergy and psychic effects on the intestine are far apart. Kuntz, who wrote an important book on the autonomic nervous system, says that allergic reactions are based on excessive parasympathetic activity. This was apparently shown by Dr. Harold Wolf and his co-workers at the New York Hospital. They observed the mucosa of the colon through colostomies under various conditions of emotional stress and strain. They found that the effects produced by certain emotional stresses were the same as the effects produced by parasympathomimetic drugs. I know an intelligent middle-aged woman who suffered for years with food allergy so that her diet was greatly restricted. She was completely relieved of her allergic responses to foods after submitting to psychoanalysis.

At the time Dr. Goin sent me the films of the first case, I showed them to my associates with the patient's story, as a striking example of the effect of the emotions on the intestines. One of my colleagues who was brought up in the Jewish religion told me that the rabbis are quite familiar with the occurrence of intestinal symptoms associated with psychic conflicts in certain Jewish people who have attempted to emancipate themselves, as Dr. Goin said, from the old dietary laws. Doubtless religious leaders of other faiths have seen similar phenomena.

Acute Fulminating Idiopathic Ulcerative Colitis

Report of a Case Showing Unusual Roentgenologic and Clinical Features[1]

KENNETH L. McEWEN, Major, M.C., U. S. A., and ELMER A. LODMELL, Colonel, M.C., U. S. A.

THE COURSE WHICH ulcerative colitis may follow is as variable as the ideas and opinions expressed in the voluminous literature dealing with every conceivable aspect of the disorder. This thought is conveyed by Mackie (1), who states that "chronic ulcerative colitis remains one of the most controversial problems in the field of disorders of the gastro-intestinal tract; opinion is divided as to classification; there is marked divergence of opinion concerning the natural history of the disease and its prognosis; there is no agreement concerning etiology, and no uniformity in the various philosophies of treatment."

The case to be presented here casts no light on the obscure problem of etiology, nor are any suggestions offered or implied as to new or improved methods of diagnosis or treatment. The diagnosis was made from an analysis of the history and the findings at physical examination and by correlating these with the objective evidence of intestinal disease as revealed by the proctosigmoidoscopic and roentgenologic examinations (2). This case of ulcerative colitis presents several unusual features, illustrating roentgen manifestations of diffuse mucosal ulceration as severe and extensive as any in our experience, and showing apparently complete, though possibly temporary, clinical and roentgenologic evidence of recovery in a remarkably short period of time. The "potential reversibility" of ulcerative colitis has been emphasized in a recent report by Kirsner, Palmer, and Klotz, (3) and this case presents another spectacular example. The proctosigmoidoscopic findings in this instance did not offer an accurate estimation of the extent of the mucosal damage. The fact is also illustrated that the roentgen appearance of the colon is not a reliable prognostic guide (4).

The only element of apparent therapeutic specificity demonstrated in this case might be the administration of aureomycin, 2.0 gm. daily for a period of ten days, for the purpose of controlling the inevitably associated secondary infection in the colon. Also of interest, since one school of thought holds that a large proportion of the cases of ulcerative colitis are of psychogenic origin, are the obvious emotional factors which, in this instance, are too coincidental to ignore as significant in precipitating at least this acute episode of colitis gravis.

A 23-year-old white male, with four and one-half years of Army service, entered the hospital on Jan. 11, 1951, because of abdominal pain and diarrhea. Approximately one month prior to the onset of his symptoms, the patient had violated duty regulations and because of this was subjected to court martial proceedings resulting in several weeks of confinement and reduction in grade. (An elaboration of the personality conflict and emotional ramifications complicating the case are not presented here but were real enough to be considered significant as a precipitating factor in the subsequent course of events.)

On Jan. 7, 1951, shortly following his release from the guardhouse, the patient began to experience sharp pains in the right lower quadrant, which became persistent and severe during the next three days. He was hospitalized on Jan. 11, and later on the same day watery diarrhea and headache developed. Although at the time of admission, examination revealed mild muscle guarding over the lower abdomen, marked tenderness in the right lower quadrant on deep palpation and on rectal examination, and hypoactive bowel sounds, prompting a tentative diagnosis of acute appendicitis, subsequent observation and examination failed to support that diagnosis. Diarrhea continued, increasing in severity the following day, and dark blood was noted in each stool. Concurrently there was fever, with an initial temperature of 101.2°, gradually rising to a peak of 103° by the fourth day.

On Jan. 15, 1951, a proctosigmoidoscopic examination showed the mucosa of the proximal portion of the rectal ampulla to be markedly hyperemic, granular, and friable, with considerable free blood in the mucoid discharge covering the walls. The mucosa of

[1] From Letterman Army Hospital, San Francisco, Calif. Accepted for publication in November 1951.

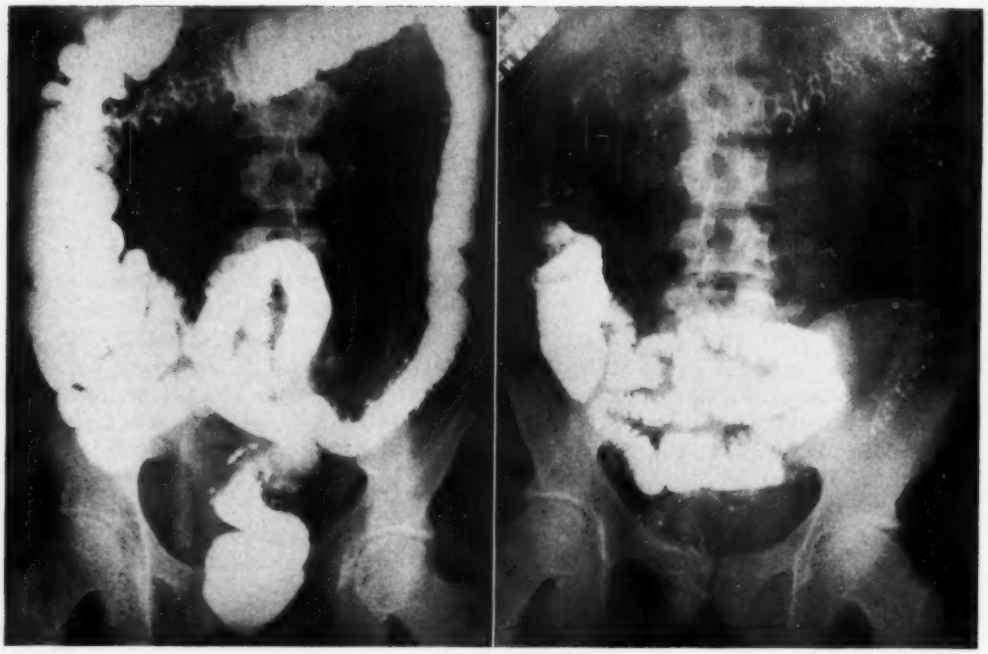

Fig. 1. Initial barium enema study, eight days after onset of diarrhea. Multiple shaggy, undermining ulcerations deeply penetrate the mucosa, from the rectosigmoid area to the mid point of the transverse colon.

Fig. 2. Magnification of the sigmoid and descending portion of the colon in the initial study. In addition to the ulcerations, thickening (edema) of the bowel wall is apparent on the evacuation film.

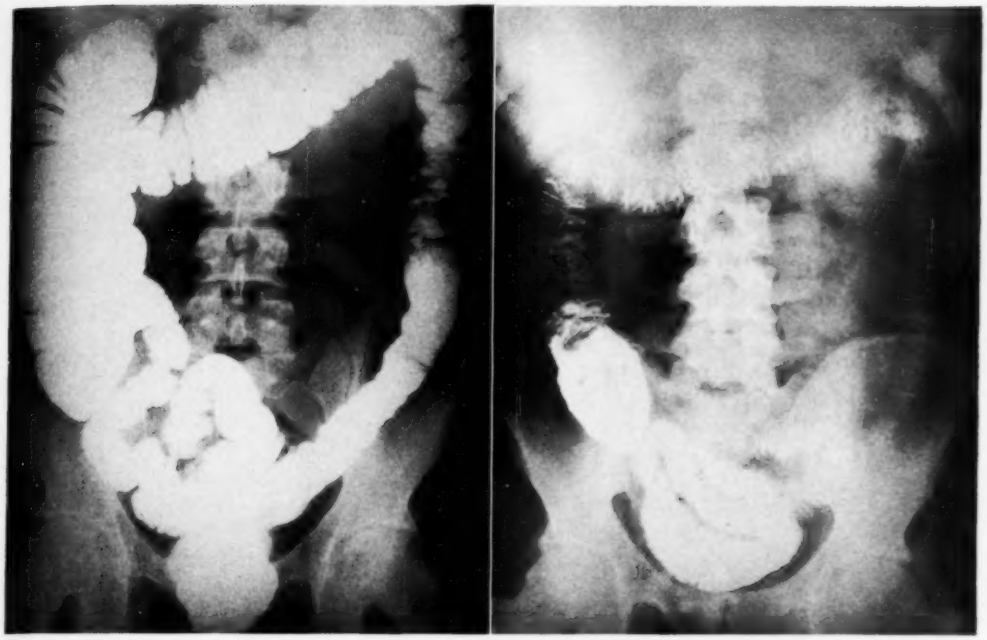

Fig. 3. Second barium enema study, two weeks after the initial examination, illustrating the remarkable degree of reversibility that has occurred. The extensive and penetrating ulcerations have disappeared. The only evidence of abnormality was irritability noted on the roentgenoscopic examination.

the lower sigmoid and rectosigmoid regions presented an identical picture to the depth of 25 cm.

The initial barium enema study was performed on Jan. 19 (Fig. 1). The barium was observed to pass quite rapidly through the large bowel and into the terminal ileum. A moderate degree of irritability of the colon was observed, with some inconstant effacement of the haustral markings and spasm, particularly in the sigmoid and descending portions of the colon. The striking feature, however, was the presence of multiple shaggy, undermining ulcerations deeply penetrating the mucosa (Fig. 2); these were numerous and extensive from approximately the rectosigmoid junction to the mid point of the transverse colon. The ulcerations in the right half of the colon were not so numerous or so large. The outline of the barium-filled cecum was slightly irregular, which may have been due to mucosal inflammation and superficial ulceration. The terminal ileum appeared normal.

The patient received no antibiotics at first, but was treated solely with intravenous fluids, tincture of belladonna, and sedatives. On Jan. 18, treatment with aureomycin was begun, 2.0 gm. daily for a period of ten days. Although hemoglobin determinations were consistently within normal limits (dehydration probably masking anemia), four daily transfusions of 250 c.c. of whole blood were given. By Jan. 22 the patient had shown marked symptomatic improvement and he was started on a bland, low-residue diet.

Proctosigmoidoscopy was repeated on Feb. 2, showing evidence of slight improvement. Friability and granularity of the rectosigmoidal mucosa was noted, and a diagnosis of thrombo-ulcerative colitis in early remission was made. A repeat barium enema study on Feb. 5 (Figs. 3 and 4) revealed disappearance of the extensive mucosal ulceration involving the left half of the colon which had been such a prominent feature sixteen days previously. The only evidence of abnormality remaining was irritability of the colon, particularly of the sigmoid and descending portions.

Throughout the remainder of the patient's hospital stay, the number of stools gradually decreased from twenty per day at the height of his illness to an average of one or two, which were grossly normal in consistency and contained no blood, pus, or mucus. Cultures of the stools were repeatedly negative. A 4+ guaiac reaction for blood, obtained on several occasions, later became negative. Other laboratory findings were not significant.

Several repeat roentgenologic and proctosigmoidoscopic examinations showed progressive clearing of the manifestations of colitis. After the patient had become completely asymptomatic and there was no further laboratory evidence of disease, he was permitted a thirty-day convalescent furlough. After

Fig. 4. Magnified view from the second study of those segments of the colon which had shown such marked changes on the initial study.

his return, a proctosigmoidoscopic examination was performed (April 12) and the findings were reported as completely normal except for one 2 × 2-cm. area on the anterior rectal wall, which was velvety, granular, and hyperemic in appearance, and which was friable and bled easily. During the previous month he had had one soft stool daily, without blood or mucus.

COMMENT

A case of acute, fulminating ulcerative colitis is presented in which the roentgenologic features and subsequent clinical course are unusual, demonstrating a remarkable degree of "reversibility." Because of the variable and unpredictable nature of this disease, we believe that this unusual case merits attention, since such experiences tend to place a limit on prognostic efforts in any given instance. This case lends support also to the following opinions stated in a vast and controversial literature dealing with ulcerative colitis: that the roentgen appearance of the colon is not a reliable prognostic guide, that the proctosigmoidoscopic findings do not always offer an accurate estimation of the extent of mucosal damage, and that no definite criteria exist by which a long-range prognosis can be established in any given case.

It is, of course, recognized that in such an acute case as this the ultimate prognosis must remain in question until a longer interval has elapsed. The findings after six months or a year should be of interest.

Letterman Army Hospital
San Francisco, Calif.

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SUMARIO

Colitis Ulcerada Idiopática Fulminante Aguda. Presentación de un Caso que Revelaba Extrañas Características Roentgenológicas y Clínicas

En el caso descrito de colitis ulcerada fulminante aguda, las características radiológicas y evolución clínica fueron extrañas, mostrando notable "reversibilidad." Este caso presta apoyo a las siguientes opiniones expresadas en una vasta y litigiosa literatura: que el aspecto roentgenológico del colon no constituye un guía fidedigno en el pronóstico, que los hallazgos proctosigmoidoscópicos no ofrecen siempre una valoración exacta de la extensión de la lesión mucosa, y que no existen pautas bien definidas para establecer un pronóstico a largo plazo en ningún caso dado.

Massive Fatal Embolism During Barium Enema Study[1]

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BARIUM SULFATE suspension has passed through the wall of the intestinal tract during a barium enema study when a perforation has been present. Opaque material from the uterus has on occasion entered into the pelvic veins during hysterosalpingography. The passage of barium through the mucosa of the colon into the venous system is, however, a medical curiosity. A careful search of the literature has revealed only one report of barium entering the veins. This occurred during the course of a barium enema in a patient with ulcerative colitis, resulting in liver abscess (1). In the case to be reported here no grossly demonstrable lesion of the colon existed. Barium passed through the wall of the rectum into the pelvic veins and thence to the lungs, with immediate fatality.

CASE REPORT

A 78-year-old white woman was admitted to the Lutheran Hospital of Maryland on Aug. 30, 1950, in a stuporous condition. During the four years prior to admission, she had been known to have hypertension, and in the last two years, she had had five convulsive seizures. Two weeks prior to the present admission, she began to refuse all foods; she grew progressively weaker, and her gait became staggering. She had suffered obstipation for at least eight days.

Physical examination at the time of admission revealed bilateral senile cataracts. The heart was slightly enlarged to percussion. The heart sounds were forceful, with a slightly accentuated second aortic sound. A short harsh systolic blow was described at the apex but was not transmitted. Blood pressure was 180/75. There was noticeable tremor of the hands. Deep tendon reflexes were sluggish throughout. The abdomen was soft; no masses or organs were palpable. The remainder of the physical examination was non-contributory.

Blood studies showed hemoglobin 88 per cent; leukocytes 10,650, with a normal differential count; sedimentation rate 40. One stool specimen was negative for blood. Gastric analysis showed no free hydrochloric acid, but there was a response to histamine injection. An electrocardiogram indicated a sinus tachycardia with abnormal P waves, pointing to left heart strain.

Roentgen examination of the chest was interpreted as showing slight enlargement of the heart shadow to the left with accentuation of the vascular markings in both lung fields and calcification of the cartilaginous rings of the trachea and of the main bronchi. Roentgenographic studies of the skull were negative.

The patient was placed on bed rest and parenteral feedings. On the second hospital day her mental attitude improved. She became more alert and oriented in all spheres and was able to take a liquid diet. However, an attempt to force fluids by mouth resulted in nausea, vomiting, and abdominal distention.

As part of a gastro-intestinal investigation and because of the obstipation, a barium enema was given on Sept. 5, 1950. A Bardex bag was inserted into the rectum and inflated under fluoroscopic control. The barium filled the rectum. The patient began to strain down, as in an attempt to defecate. The injected barium was seen to assume a peculiar stringy appearance, and it was suddenly realized that it conformed to the shape of pelvic vessels adjacent to the rectum. The enema was immediately stopped and the Bardex bag deflated. The patient became extremely apprehensive, tried to rise, but fell back and expired within four or five minutes. A roentgenogram of the abdomen was made shortly after death (Fig. 1), showing opaque material in the rectum, the sigmoid colon, and in the adjacent hemorrhoidal and pelvic veins.

Pathological Summary: Upon opening the body the abdominal viscera appeared normal and showed the usual relationship one to the other. Within the thorax the lungs were air-containing and the pleura was smooth and glistening. There was no free fluid. The heart was normal in size and position. The pericardial cavity was intact.

The right lung was found to weigh 270 gm. and the left 260. The external appearances were similar. Both were purplish pink to grayish blue in color; both were crepitant, and on section appeared yellowish red, with moderate edema. Thrombi were not grossly evident in any of the pulmonary vessels. The heart weighed 330 gm. Its external surface was normal, and internally no abnormalities were seen. The left ventricular wall measured 2.3

[1] From the Departments of Roentgenology, Pathology and Medicine of the Lutheran Hospital of Maryland, Baltimore, Md. Accepted for publication in November 1951.

cm. in thickness and the right 0.5 cm. The valves were all delicate and competent. There was no atherosclerosis of significant degree. The liver, spleen, kidneys, adrenal glands, pancreas, and the urinary bladder showed no pathologic change.

Examination of the digestive tract revealed a normal esophagus. A small healed ulcer was noted on the lesser curvature of the stomach near the pylorus. The small intestine showed no pathologic change. Upon opening the colon, there was no evidence of erosion, ulceration, or any grossly

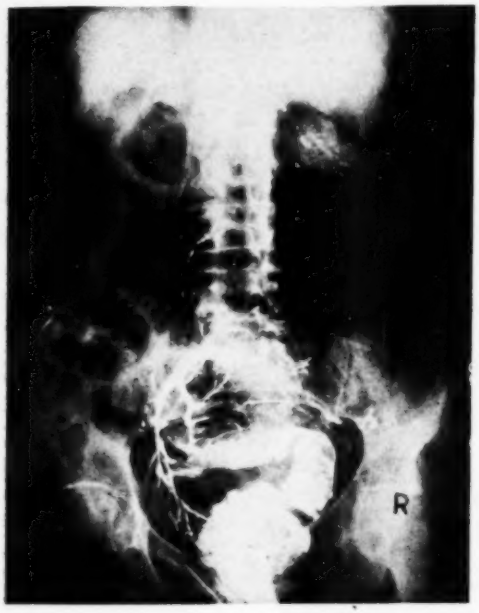

Fig. 1. Film of the abdomen made shortly postmortem, showing barium in the rectum and sigmoid colon, the hemorrhoidal veins, the hypogastric vein and the inferior vena cava.

visible external defect either in the ascending, transverse, descending, or sigmoid portion or in the rectum. The barium had been injected up to 14 cm. above the anus. Most of it had been previously evacuated, leaving a few small flakes on the mucosal surface of the sigmoid.

After fixation, a re-examination of the sigmoid and rectum down to and including the anus revealed no grossly visible points of erosion, fissuring, or other rupture of the mucosa.

The portal system and the pelvic venous system (including the hemorrhoidal system) were next dissected and the majority of the veins were exposed. This dissection was carried down to the rectum, which was also removed. On opening the inferior vena cava, a few firm scattered clots were noted within the vessel. On following this vessel, a few plaques of barium were found in the hypogastric

Fig. 2. Roentgenogram made during autopsy, demonstrating barium in the right kidney. Microscopic sections showed this to be in the renal vessels and glomeruli.

vein. Nothing abnormal was noted upon opening the portal vein.

The brain weighed 1,270 grams and was normal in every respect.

Microscopic studies showed no primary pathologic change of a significant degree in any of the thoracic or abdominal viscera. Such minor lesions as minimal emphysema were noted along with slight atelectasis in both lungs. Within some of the branches of the pulmonary vessels were numerous foreign bodies which were whitish and granular in nature, some showing crystals which were morphologically identical with samples of barium sulfate contrast mixture placed under the microscope. This material was not associated with thrombi or with inflammatory changes. The liver histologically was normal. In the kidneys fine granular material again was noted in the branches of the renal vessels and in several glomeruli (Fig. 2). The heart appeared normal. The pancreas and spleen were also intact. Foreign material was not found in these organs.

Sections through the large intestine showed superficial mucosal erosion in various areas, with some slight to moderate acute inflammatory processes with a predominance of polymorphonuclear neutrophils. The muscle layers were normal, and no foreign material was found within the blood vessels.

The pathologic findings in this case do not reveal a primary cause of death other than that indicated by the radiologic findings. The presence of foreign material in the blood vessels of the lungs and kidneys, along with the presence of mate-

rial histologically similar to the barium mixture supports the radiologic findings postmortem. Examination and re-examination of the lower colon failed to reveal the point of entrance of the barium, although it would appear that this was most probably a small fissure or superficial varix. There was no evidence of trauma of the type which could have been caused by instrumentation.

Diagnosis: Diffuse foreign body embolization, lungs and kidneys.

COMMENT

The complications of barium enema examination are few and usually of minor importance, but in this case resulted fatally. The actual point of entrance of the barium was not demonstrated and the mechanism of embolization is a matter of conjecture. The most probable explanation is that the inflation of the Bardex bag and the straining of the patient caused a fissure or varix to open, through which the barium was able to enter the venous system.

SUMMARY

A case is reported of death resulting from barium embolism during a barium enema examination.

NOTE: Grateful acknowledgment is made to the Department of Art of the University of Maryland Medical School for preparation of the photographs, and to Mrs. Margarite Brown for technical assistance.

700 Ashburton St.
Baltimore 16, Md.

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SUMARIO

Embolia Masiva Letal Durante un Examen con Enema de Bario

El caso letal comunicado tuvo por causa una embolia bárica durante un examen con enema de bario. A medida que se llenaba el recto, el enfermo comenzó a esforzarse como si fuera a defecar. Observóse que el bario tomaba un peculiar aspecto filamentoso, y se comprendió de repente que había tomado la forma de los adyacentes vasos pelvianos. Se suspendió en el acto el procedimiento, pero el sujeto murió a los pocos minutos.

Una radiografía tomada poco después de la muerte reveló substancia opaca en el recto, la S ilíaca, y las adyacentes venas hemorroidales y pelvianas. El examen anatomopatológico puso de manifiesto numerosos cuerpos extraños en las ramas de los vasos pulmonares, algunos de los cuales mostraban cristales morfológicamente idénticos a las muestras del sulfato de bario de medio de contraste.

La autopsia no reveló el punto de entrada del bario en los vasos, aunque parece haber sido una pequeña hendidura o várice.

Syphilis of the Stomach[1]

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THE TERM "syphilis of the stomach" is applied to the lesion that occurs in the tertiary stage of the disease. Although the incidence is much lower than that of ulcer, cancer, or gastritis, the condition is not rare, as a review of the literature indicates. It is estimated that in the United States 0.3 per cent of patients with syphilis have involvement of the stomach (Bockus). In review of the cases of syphilis seen at University Hospital in the past ten years, however, only two with gastric lesions fulfilling the necessary criteria were found.

In the majority of cases reported in the literature, the diagnosis was made clinically, only a few being established histopathologically. The criteria usually accepted for the clinical diagnosis of gastric syphilis are: (1) untreated tertiary syphilis, (2) a demonstrable roentgen defect, (3) presence of gastric symptoms, (4) inability to alleviate symptoms or effect any improvement in the anatomic x-ray defect by orthodox methods of management without antisyphilitic therapy, and (5) symptomatic relief with disappearance of the x-ray defect after intensive specific therapy.

Eustermann, for purposes of clinical analysis, divided the cases into three groups: (1) syndrome suggestive of reduced stomach capacity, with onset of pain immediately after meals, dyspepsia, and vomiting as the outstanding features, 63 per cent; (2) pseudo-cancer type, with gradual onset of symptoms and mild discomfort unrelieved by ingestion of food and alkalis, 15 per cent; (3) the ulcer type, with pain-food-ease sequence, 22 per cent. Our two cases fall into the first and third categories.

The pathological diagnosis of gastric syphilis is difficult. Some pathologists insist on isolation of the spirochete for a definite diagnosis. Singer and Dyas, however, believe that the recovery of the specific organism from the gastric lesion should not be necessary, since spirochetes are rarely found in tertiary lesions elsewhere. There is only one case in the literature (Harris and Morgan) in which the spirochete was isolated from the gastric lesion as well as from a regional lymph node. The removed material was injected into a rabbit's testicle and a typical testicular syphiloma developed, yielding multiple spirochetes.

Other pathologists consider the presence of a gumma with its classical three zones as sufficient evidence on which to base a diagnosis. These zones consist of (1) a caseous center, (2) a middle zone of fibrous tissue, and (3) an outer layer of young granulation tissue rich in inflammatory elements. True classic gummata in the stomach, however, are rare. Indeed, no part of the alimentary tract lends itself ideally to the formation of a gumma.

Singer and Dyas maintain that the diagnosis of gastric syphilis may be based on the same criteria as syphilis elsewhere (*e.g.*, aortitis), in the absence of spirochetes or gummata. The lesion starts in the submucosa with changes in the arteries (proliferating endarteritis) and veins (panphlebitis). Usually the involvement is more diffuse, producing some swelling and thickening of the wall of the stomach. No actual tumor may be present, but an extension of the granulomatous process, resulting in the linitis plastica type of stomach. Large serpiginous ulcers, often multiple, have been described.

According to Moore and Aurelius, whose observations are substantiated by others,

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Fig. 1. Case I. The opaque meal shows a large filling defect with luminal shrinkage, irregular narrow canalization, and absence of peristalsis, involving the distal two inches of the stomach, up to the pylorus.

the roentgen defect occurs in the pyloric or prepyloric region in 70 per cent of the cases. The hour-glass deformity was found in 22 per cent and there was diffuse involvement in 8 per cent.

CASE I: L. P., a 72-year-old white female was admitted to University Hospital on Dec. 31, 1946, complaining of generalized abdominal pain, anorexia, a sense of fullness after eating, periodic vomiting, and constipation. There had been a 30-pound loss in weight in six months. The remaining history was non-contributory. Syphilitic infection was denied.

The patient was moderately emaciated, with a large, tender, firm, somewhat indefinitely outlined mass in the epigastrium.

Roentgen examination revealed what was described as a scirrhous type of neoplastic infiltration of the distal two inches of the antrum with obstructive tendency. The lumen was reduced, peristalsis was absent, and a filling defect was demonstrated, suggesting a neoplasm.

Laboratory examination on Jan. 13, 1947, revealed a 4-plus Kahn reaction. Hematologic and chemical findings were normal.

The patient was operated upon on Jan. 8, a total gastrectomy being performed. Grossly the lesion was considered malignant. Death from acute pulmonary edema and bronchopneumonia ensued on Jan. 15.

The pathologic report on the removed stomach was in part as follows: The principal lesion is a large plaque-like thickening of the stomach wall, overlying which are multiple ulcerations. This extends for about 13 cm. along the lesser curvature, starting about 2 cm. proximal to the pyloric sphincter. In this area the stomach wall is thickened to about three times its dimension elsewhere. It is stiffened and less pliable than usual, although not so hard as tumor infiltrations. The thickening involves principally the submucosa. There are multiple ulcerations, the largest extending along the lesser curvature for 8.5 cm. over the central portion of the plaque. The ulcer is shallow, penetrating only the submucosa; its margins are ragged, serpiginous, and hyperemic, its floor granular and moderately firm.

Microscopic sections through the involved area show that the stomach is the seat of a diffuse, chronic granulomatous infiltration which involves the mucosa and submucosa, and in some areas the muscularis, but with its principal seat in the submucosa. The submucosal thickening is due to hyperemia, edema, fibrosis, and a diffuse chronic inflammation. The ulcers have fairly abrupt walls, only occasionally slightly undermined. The floor is composed of granulation tissue, rich in plasma cells around small blood vessels.

In addition, there are specific appearing granulomas, both in the mucosa and submucosa, either tuberculoid aggregations or more diffuse conglomerations of epithelioid-like cells, with an admixture of various acute and chronic inflammatory cells. In such granulomas, there are found multinuclear giant cells, only rarely resembling the Langhans' type, more generally with centrally disposed nuclei. Many of the arteries show slight thickening and reduplication of the elastica and irregular intimal proliferation by loose fairly cellular fibrous tissue. The veins show a panphlebitis, with invasion of the walls by granulation tissue. (Such panphlebitis with invasion of the lumen by granulation tissue has been stressed in the literature.)

In one sectioned lymph node, there is found in the cortex a granuloma similar to that in the stomach, with multinucleated giant cells.

Further substantiation of the diagnosis of gastric syphilis was obtained on postmortem examination, when a syphilitic cirrhosis of the liver (*hepar lobatum*) was found. Cardiovascular syphilis was not present.

CASE II: D. N., a 35-year-old Negro male, was admitted to University Hospital on Nov. 12, 1947, because of recurrent attacks of epigastric pain. These were described as "squeezing" in character. Two weeks prior to admission, associated episodes of vomiting developed. The pain was relieved by milk and food, only to recur two hours later. It often awoke the patient from sleep. There had been a 10-pound weight loss in five weeks.

The patient gave a history of having a penile chancre ten years previously.

Physical examination was non-contributory, revealing only epigastric tenderness on deep palpation. The Wassermann reaction was 4-plus. Blood

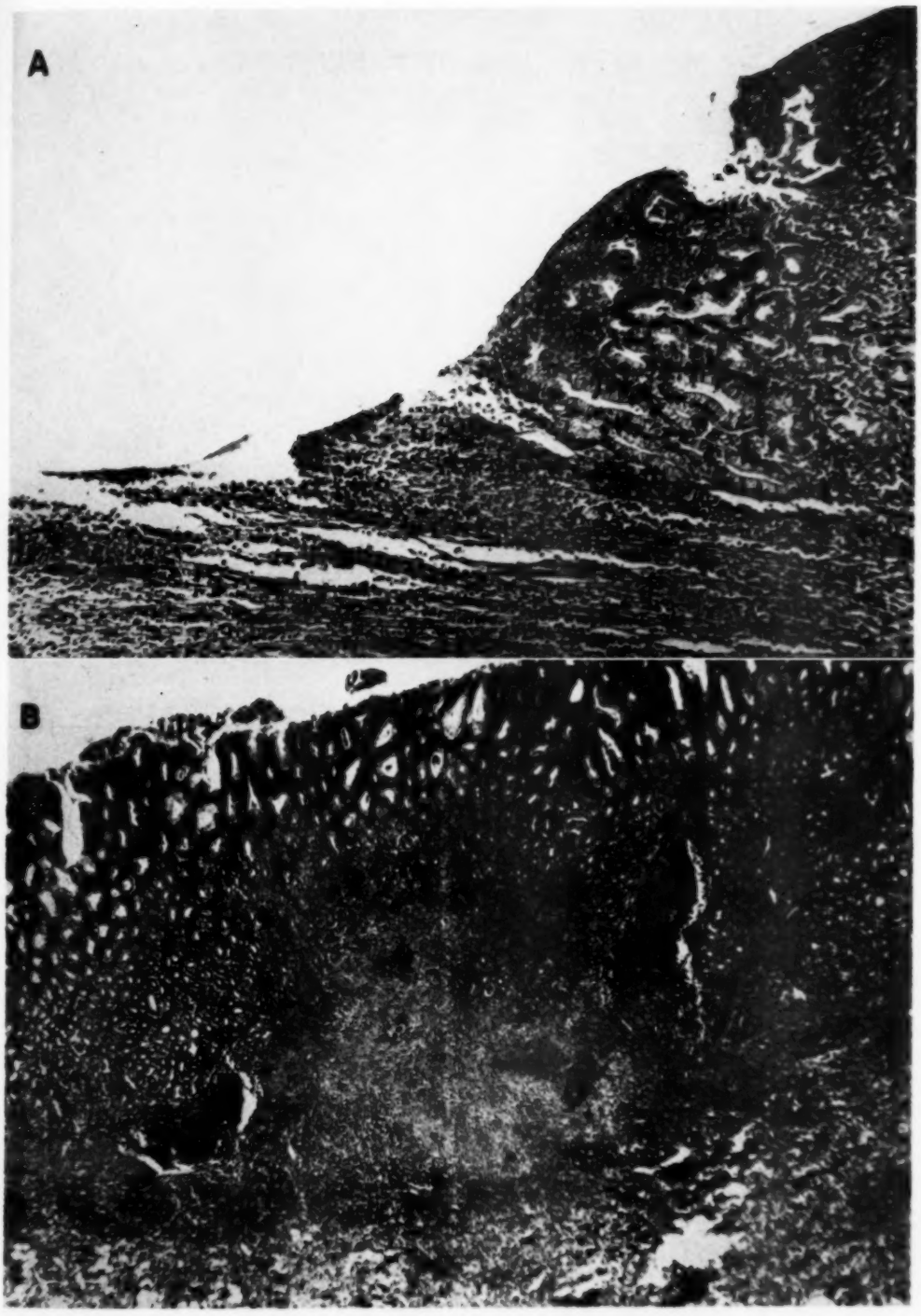

Fig. 2. A. Section through an ulcer: floor composed of granulation tissue rich in plasma cells, around small blood vessels; submucosal thickening due to hyperemia, edema, and diffuse chronic inflammation.
B. Section through a granuloma in the submucosa, showing a diffuse conglomeration of epithelioid-like cells, with an admixture of various acute and chronic inflammatory cells. There are several multinuclear giant cells.

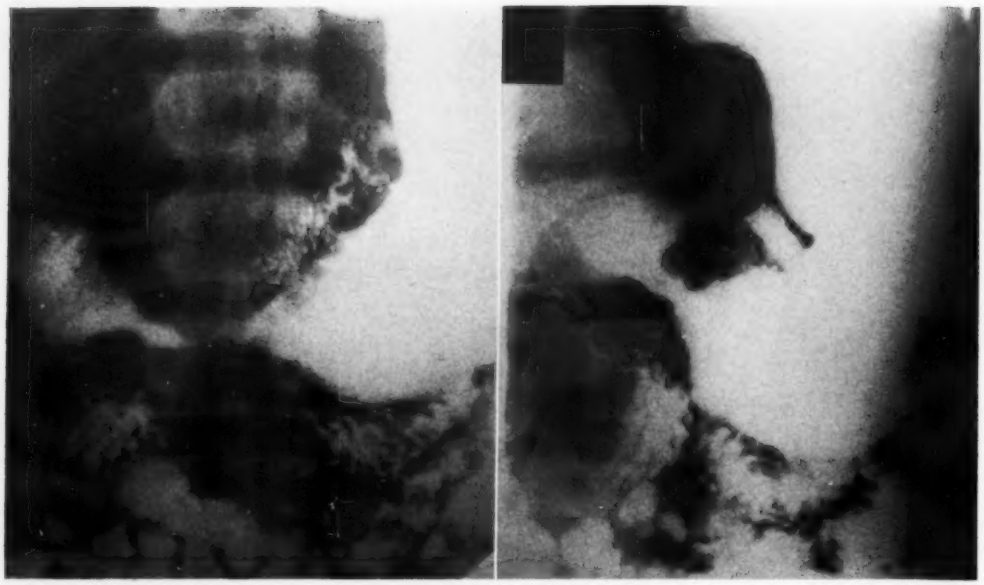

Fig. 3. Case II: Gastro-intestinal study made on Nov. 19, 1947, showing a filling defect at the pyloric end of the stomach, with peristaltic disturbance, irregular luminal narrowing, and canalization with persistent patency of the pylorus.

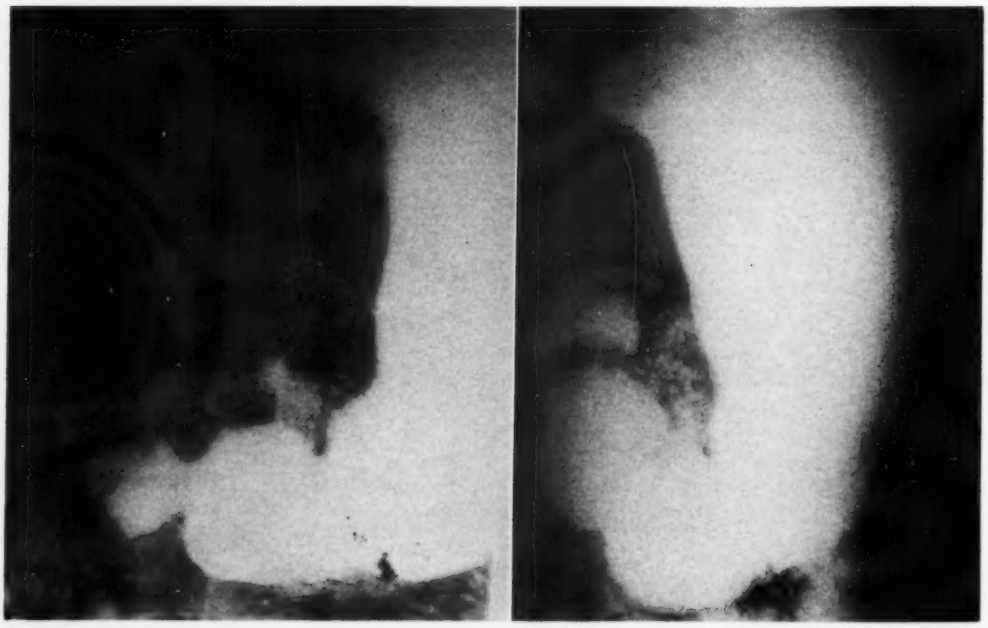

Fig. 4. Case II: Re-examination on June 12, 1948, after intensive antisyphilitic therapy. The filling defect has disappeared. There are normal distensibility and peristalsis with normal intermittent action of the pylorus.

and urine studies were normal. A 4-plus Kahn and 4-plus Mazzini reaction were obtained. The spinal fluid was negative; colloidal gold reaction was never above 1.5.

A gastro-intestinal roentgen examination was performed on Nov. 19, showing a filling defect at the pyloric end of the stomach, with peristaltic disturbance. There was an area of luminal narrowing and canalization measuring about half an inch in length. This extended into the pyloric ring, which had lost its usual intermittent action and was persistently patent.

The diagnoses considered were antral gastritis, specific or non-specific, and a neoplastic lesion. Because of the location and character of the lesion, as well as the clinical history and positive serology, syphilitic involvement was considered the most likely, and operation was withheld.

Routine medical therapy had not helped the patient prior to hospitalization. Now specific therapy was undertaken. Seven million units of penicillin and 1 c.c. of bismuth were given. The symptoms became less severe and the patient was discharged, to be followed as an out-patient. In the clinic he was given weekly injections of 1 c.c. of bismuth, from Jan. 17 to June 12, 1948. His only complaints were regurgitation and eructations. Repeat gastro-intestinal studies undertaken during this period showed gradual improvement until a completely normal appearance was finally demonstrated on June 12, 1948. The entire defect had disappeared. The pyloric ring was normal in size and appearance, exhibiting normal rhythmic intermittent relaxation and closure.

While pathological proof was not obtained in this latter case because of the favorable course, all the criteria of syphilis of the stomach were met, namely untreated tertiary syphilis, a roentgen gastric defect, persistence of symptoms on orthodox therapy and improvement on antisyphilitic therapy, with disappearance of the roentgen defect.

SUMMARY

Two cases of gastric syphilis are presented, each with a pyloric lesion. One came to autopsy and was proved pathologically. The other was diagnosed by clinical, roentgen, and laboratory methods, meeting all the recognized and usually accepted criteria for gastric syphilis.

NOTE: The authors wish to express their appreciation to Dr. Maurice Richter for his help in reviewing the pathological specimens, and for the use of his pathological report.

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SUMARIO

Sífilis Gástrica

Preséntanse 2 casos de sífilis gástrica, con lesión pilórica. En uno, hubo ocasión de verificar la autopsia, y se comprobó anatomopatológicamente el diagnóstico. El otro fué diagnosticado a base de los hallazgos clínicos, radiológicos y de laboratorio, conformándose a las pautas reconocidas para dicha dolencia.

A New Technic in the Study of the Mucosal Pattern in the Cardiac Area of the Stomach[1]

FEDERICO GARCIA CAPURRO, M.D.,[2] and JUAN CARLOS PECANTET, M.D.[3]

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IN THE CHRONOLOGICAL development of methods for the roentgen examination of the stomach, the older procedures consisted in the demonstration of filling defects, produced by large lesions, in an opaque medium. Later, more refined technics made it possible to outline the mucosal pattern with a thin layer of barium, under controlled compression, thus revealing involvement at an earlier stage.

The different regions of the stomach, however, have not benefited equally from this improved technic. Whereas in the body of the stomach, the antrum, and pylorus, the mucosal folds are demonstrated with great clarity, in the region of the cardia dependence is still placed on the older procedures, which reveal only the more advanced lesions. The most important obstacle in the way of study of the mucosal relief in the cardiac portion of the stomach is its anatomical position, hidden behind the thoracic cage, where it is inaccessible to compression. In addition, since this part of the stomach forms a cavity of considerable size, it is impossible to secure an even distribution of the barium in a thin layer. Instead, it collects in an opaque mass, obscuring all details. The Trendelenburg position, formerly considered basic for examination of this zone, only serves to exaggerate these drawbacks. Actually this position is useful only in the visualization of lesions on the margins of the gastric chamber and is quite useless in the diagnosis of disease involving the anterior or posterior surfaces and in the cardia.

We have found it possible to study the cardiac portion of the stomach with the aid of procedures which bring about deflation of the gas bubble so that the walls approach each other and the cavity becomes similar to the remainder of the stomach. The barium then flows through this space in a thin layer, permitting observation of the mucosal folds.

Our first studies were done with pneumoperitoneum, which we frequently use when the surgeon wishes to find out if a carcinoma in the area of the cardia has extended beyond the stomach and has become adherent to the adjacent organs. We make use of this procedure, also, in the differential diagnosis of shadows sometimes appearing in the clearness of the air bubble which actually represent organs in the neighborhood of the stomach.

Apart from these uses, which have been known for years, we have resorted to pneumoperitoneum to collapse the gastric chamber with the object of visualizing the mucosal relief. In many cases we have been able to push out the gas in the bubble completely, reducing the fundus to a spindle-shaped segment very much like the esophagus (Fig. 1). By this means, the course of the folds which have a normal structure can be followed quite clearly. In other cases air in the area of the cardia has remained in place in spite of the injection of large quantities of gas into the peritoneum. Having thus failed in our attempt to bring the walls into contact, we were obliged to find a way of eliminating this remaining air. To accomplish this, we made use of a duodenal tube and a syringe of 100 c.c. capacity, to draw out the gastric air. Later we found that aspiration of air by this means gave as good results when employed alone as when combined with pneumoperitoneum. We

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have therefore adopted this extremely simple procedure as a routine for studying mucosal relief in the zone of the fundus.

After elimination of the air, which is done under fluoroscopic control, we place the patient on his back, retract the tube as far as the thoracic esophagus so that it

Fig. 1. Collapse of the gastric chamber by means of pneumoperitoneum.

will not interfere with study of the abdominal esophagus, and inject a small amount of barium (10–15 c.c.) through the tube. The medium will spread in a thin layer between the folds of the cardiac area, which become clearly visible. This technic allows also a good study of the cardia itself, which stands out among the mucosal folds. Furthermore, as the barium flows slowly through the abdominal esophagus and cardia, spot films are more easily obtained than with the usual technic.

Fig. 2. Collapse of the gastric chamber by aspiration.

SUMMARY

Collapse of the gastric air bubble is suggested as a useful procedure for the diagnosis of incipient lesions in the cardiac area of the stomach. This is accomplished (1) by evacuation of the air with the aid of a duodenal tube through which the contrast medium can be introduced after aspiration is complete, (2) by pneumoperitoneum, or (3) by a combination of the two procedures. Aspiration is preferred for study of the mucosal relief. Pneumoperitoneum is useful for the diagnosis of lesions growing out of the stomach and for differentiation of extragastric lesions.

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(*Para el sumario en español, véase la página siguiente*)

SUMARIO

Nueva Técnica para el Estudio del Patrón de la Mucosa en la Zona del Cardias

Como procedimiento útil para el diagnóstico de las lesiones incipientes en la región del cardias se sugiere el aplastamiento de la burbuja gástrica. Esto se obtiene mediante: (1) la evacuación del aire con la ayuda de una sonda duodenal a través de la cual puede introducirse el medio de contraste después de terminar la aspiración; (2) el neumoperitoneo; o (3) la combinación de ambos procedimientos.

La aspiración es preferible para el estudio del relieve de la mucosa. El neumoperitoneo resulta útil para el diagnóstico de lesiones que proyectan fuera del estómago y para la diferenciación de las lesiones extragástricas.

Aberrant Pancreatic Tissue in the Gastric Antrum

Report of Seven Cases[1]

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ABERRANT PANCREATIC tissue, *i.e.*, ectopic pancreatic tissue outside of the pancreatic bed, has no vascular, neural, or anatomic continuity with the pancreas proper (1). In the presence of such heterotopic tissue the pancreas itself is practically always normal.

The diagnosis of aberrant pancreatic tissue offers a challenge to the roentgenologist. Since the initial description by Schultz in 1729, and the first histologic study by Klob in 1859 (2), few reports of this anomaly have appeared in the roentgen literature (3), and in practically none of the cases recorded has the correct diagnosis been suggested even as a possibility. The reports themselves are presented with an air of amazement at the pathologic denouement. The reason for the general lack of interest in the condition is that it is commonly considered to be a rare postmortem curiosity of little or no clinical significance. Yet, when a survey was made of all the surgical cases of aberrant pancreatic tissue in the records of the Mayo Clinic to the year 1946, there were found 41 authenticated cases, of which 25 had been clinically significant. With the improvement of diagnostic and surgical procedures, there has been an increase in the ratio of surgical to postmortem reports.

An historical survey of this condition shows three fairly well defined phases (5). The older articles, constituting the first phase, were largely devoted to controversy concerning the correct embryologic explanation (6, 7). The majority of cases have been found in the vicinity of the pancreatic bed. Thus, 70 per cent are located in the wall of the stomach, duodenum, or jejunum. But such unusual locations as the liver, gallbladder, cystic duct, splenic capsule and spleen, mesentery, umbilical fistula, omentum, gastrocolic ligament, transverse mesocolon, and even the mediastinum are not unknown.

Writers in the second historical phase were concerned with the variety of serious pathological conditions arising from these anomalies. Every vicissitude to which the pancreas proper is heir has been observed as complicating the presence of pancreatic tissue at an abnormal site.

The third phase is a surgical one, but it concerns also the roentgenologist. It began with a steady increase in the use of subtotal gastric resection for chronic gastric and duodenal ulcer. The presence of aberrant pancreatic tissue in the pyloric region has produced radiographic and clinical findings so strikingly similar to those of ulcer as to lead to operative procedures admittedly more radical than the circumstances warranted. Not only peptic ulcer but cholecystitis and malignant gastric neoplasm may be clinically simulated by aberrant pancreatic tissue (8).

As roentgenologists we can be of most service to the patient in surgical cases if we remain keenly sensitive to diagnostic problems. Numerous surgical reports indicate that if the surgeon had been aware of the nature of the lesion with which he was dealing, he would have chosen a substantially different operative procedure. Making a radiological diagnosis of benign tumor is a great contribution to the care

[1] Accepted for publication in November 1951. Published with the permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or the conclusions drawn by the authors.

[2] From the Clinical X-ray Department, Hines Veterans Hospital (Dr. Israel Kirsh, Physician-in-Charge; Dr. Frank L. Hussey, Chief).

of the patient. Further refinement of this diagnosis in the light of the clinical data, will lead to a correct interpretation in a substantial number of cases.

At Hines Veterans Hospital we have seen in a period of about three years, 7 cases of aberrant pancreatic tissue in the stomach, 5 of which were personally observed by the same pathologist, Dr. William Benner, whose report in 1951 (4) contributed to an understanding of its morphology. He was puzzled by his first experience, but a study of the mucosal alterations in that instance made possible ready identification of the condition by the gross appearance in 4 subsequent cases. He believes that in many instances the surgeon can make a correct diagnosis at the operating table and, as a result, elect local excision instead of radical surgery.

The presentation of the 7 cases will illustrate our point of view.

CASE I: R. W., a 44-year-old Negro male, was admitted with far advanced pulmonary tuberculosis, to which he succumbed the following day. An incidental finding at autopsy was an umbilicated nodule on the posterior wall of the stomach, about 2.5 cm. proximal to the pyloric sphincter. This elevation measured 1 cm. in diameter and contained a central pouch-like depression (Fig. 1), beneath which was a finely lobulated mass of cream-colored tissue 1 cm. in diameter and 0.5 cm. in thickness (Fig. 2). Microscopic examination showed the mucosal depression to be associated with aberrant pancreatic tissue.

Note: This example is the prototype for our first 5 cases. In all the gross morphology was identical.

CASE II: C. K., a 50-year-old white male, entered the hospital in a moribund condition and died sixteen hours later with a massive lobar pneumonia. An incidental finding at autopsy was an oval elevation on the posterior wall of the stomach about 4 cm. proximal to the pyloric sphincter. This measured 1 cm. in diameter and 0.7 cm. in height. At the apex of this nodule was a depression about 0.6 cm. in depth. A discoid area of thickening was felt in the stomach wall subjacent to the mucosal defect. Microscopic examination revealed aberrant pancreatic tissue (Fig. 3). There was also present a Meckel's diverticulum.

This patient had been admitted to the hospital five months previously with numerous soft, small superficial masses over his body. An upper gastrointestinal examination done at that time to rule out a possible associated tumor of the stomach, such as a neurofibroma, showed mild prepyloric spasm but was considered to be negative for an organic lesion. The masses proved on biopsy to be multiple fibromas. A review of the films reveals an oval rarefaction about 4 cm. from the pyloric orifice (Figs. 4 and 5), measuring about 1.5 cm. in greatest diameter and containing a tiny central fleck of barium. It lies adjacent to the greater curvature of the antrum and is associated with a significant gastric residue. At the time the roentgen studies were made, the patient was considered to be asymptomatic from a gastro-intestinal point of view.

Note: This case illustrates how a small lesion may be missed on casual examination. In a routine asymptomatic case the roentgenologist's examination often tends to be less exact. Excessive barium in the stomach may easily obscure a small lesion. Undue reliance on fluoroscopy may fail to reveal a lesion which subsequently shows up on the films.

CASE III: J. B., a 54-year-old white man, was admitted with a history of left upper quadrant pain, nausea, and vomiting. In the hospital he had hematemesis. Physical examination was negative. Gastric analysis revealed a total acid of 38 units and free acid of 16. On three different occasions upper gastro-intestinal studies revealed severe antral spasm, with narrowing in the pyloric region and a suggestion of an ulcer crater in the prepyloric area. The bulb was never adequately demonstrated. A gastroscopic examination showed the stomach to be of cascade type. Spasm prevented visualization of the pylorus. Symptoms persisted under adequate medical management, and six weeks after admission a subtotal gastrectomy was performed.

A benign ulcer was found just beyond the pylorus, on the posterior wall of the duodenum. Near the lesser curvature, about 1.5 cm. proximal to the pyloric ring, was a mound-like elevation 0.5 cm. in diameter, with a central depression. Probing revealed an opening 0.3 cm. in diameter, leading into a deep, elongated pouch 0.4 cm. in width and 1 cm. in depth in the submucosa, where several duct-like structures opened into its base. In the adjacent submucosal tissue were several lobules of pancreatic acini and numerous ducts of varying size lined by pale cylindrical cells.

Note: This case indicates that an inflammatory lesion can produce sufficient spasm and deformity to obscure a small nodule of aberrant pancreatic tissue in the contiguous region.

CASE IV: E. B., a 31-year-old Negro male, entered the hospital with a history of belching, occa-

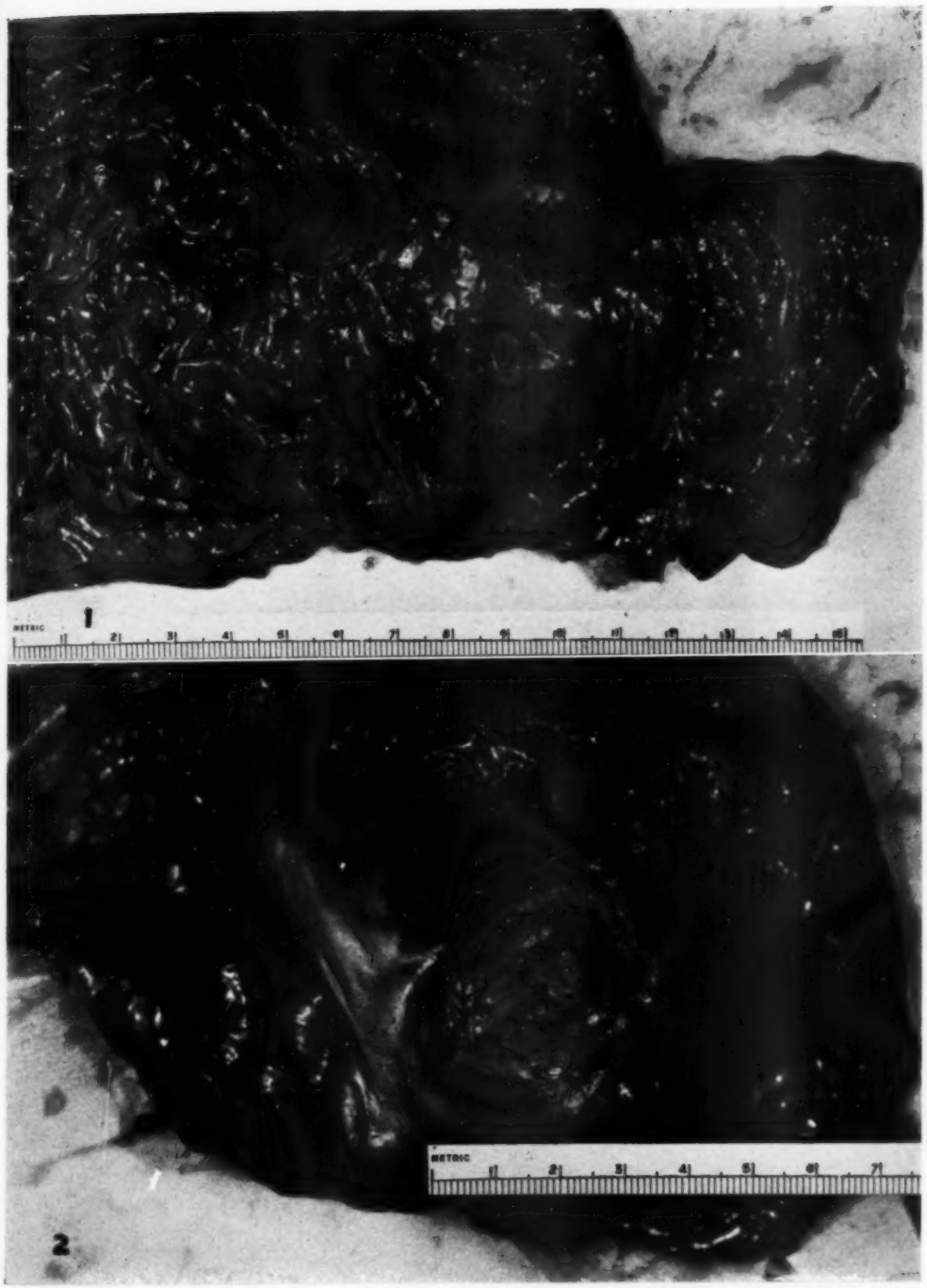

Fig. 1. Case I. Gross appearance of the lesion which has evoked such descriptive terms as "dimple," "nipple," and "navel." It may be less colorfully described as an elevation containing a central mucosal depression with aberrant pancreatic tissue at its base.

Fig. 2. Case I. View of the specimen shown in Fig. 1, from the serosal surface, with the serosa removed to show the finely lobulated mass of aberrant pancreatic tissue.

sional nausea and vomiting, and a bloating sensation, for about two and a half years. An ulcer regimen had given some relief from these symptoms, but about three months before admission, belching and vomiting had recurred. A gastro-intestinal series before admission revealed what was diagnosed as a gastric polyp in the antrum. In the few weeks before admission there had been epigastric distress especially after eating, but no vomiting.

Physical examination and routine laboratory

Fig. 3. Case II. Low-power view demonstrating the mucosal depression.

Fig. 4. Case II. The oval rarefaction contains a tiny central fleck of barium corresponding to the mucosal depression.

Fig. 5. Case II. Five-hour film, again revealing the extramucosal filling defect.

studies were negative. A barium-meal examination revealed an oval filling defect about 1.5 cm. in greatest diameter in the distal portion of the antrum, adjacent to the greater curvature of the stomach. This filling defect had a central stellate depression containing a barium fleck. The findings were suggestive of a neoplasm with a crater such as is seen in leiomyosarcoma.

Fig. 6. Case IV. Oval filling defect containing a central barium fleck in the antrum of the stomach.

An intramural lesion was considered a more likely diagnosis than gastric polyp (Fig. 6). Laparotomy revealed a small palpable nodule with a slight dimpling of the overlying serosa, in the prepyloric region, just above the greater curvature on the anterior surface of the stomach. When the stomach was opened, the nodule showed a pouting of the mucosa to form a small crater about 1.5 cm. in diameter. There was no evidence of ulceration. The nodule was locally excised.

On pathologic examination, the serosal surface showed a vague nodulation. On the mucosal surface was a mound 1.5 cm. in diameter and 1 cm. in elevation, with a central depression, 1 cm. in depth, which did not appear to be ulcerated. Microscopically, the mound and depression were found to be lined with gastric mucosa. In the adjacent submucosa was aberrant pancreatic tissue.

Note: This is almost a typical case, if one may use that term. The history extended over more than two years. The findings are not consistent with a diagnosis of gallbladder disease, duodenal or gastric ulcer, or of a malignant neoplasm. The roentgenologic examination suggested an intramural type of lesion in contrast to a polyp, the most usual diagnosis. The observer (M.L.) erred because he was unaware at the time that a crater-like defect may occur in aberrant pancreatic tissue, although he was quite aware of the existence of the lesion, having previously reported a case in the duodenal bulb which he originally mistook for a duodenal polyp (8).

Fig. 7. Case VI. A filling defect measuring 1.5 cm., on the greater curvature of the antrum near the pylorus.

CASE V: P. S., a 21-year-old white male, died of generalized reticulum-cell sarcoma. An incidental finding at autopsy was a circumscribed elevation of the gastric mucosa, about 2 cm. proximal to the pyloric ring on the posterior wall. The elevation measured 1.3 cm. in diameter and 0.5 cm. in height, with an umbilication in the center, leading into a pouch-like space about 0.5 cm. wide at the neck and 0.8 cm. wide at the base. Microscopic examination revealed the presence of aberrant pancreatic tissue. There had been no gastro-intestinal study.

CASE VI: W. B. B., a 24-year-old white male, was admitted to the hospital with a history of recurrent bouts of nausea and vomiting for four years, increasing in severity in the last three weeks. Examination elsewhere had revealed a small filling defect in the prepyloric region of the stomach, and a diagnosis of benign tumor had been made.

Physical examination and routine laboratory studies showed nothing of significance except for a total gastric acidity of 28 and no free acid. An

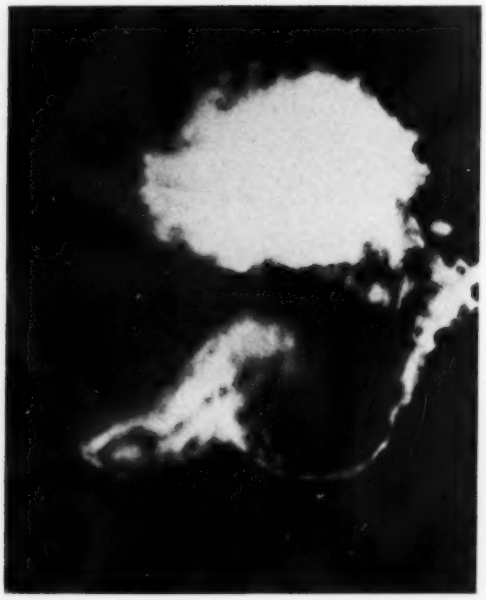

Fig. 8. Case VI. Spot film revealing a large central barium fleck in the filling defect.

upper gastro-intestinal series revealed a filling defect about 1.5 cm. in diameter on the greater curvature of the antrum near the pylorus. This defect appeared *intramural*. In its center was a small depression filled with barium (Figs. 7 and 8). The following possibilities were suggested in the radiologic report: (1) benign tumor; (2) ulceration in a malignant tumor; (3) *aberrant pancreas;* (4) leiomyosarcoma. Gastroscopy was negative.

At surgery, a firm mass of tissue, about 1 × 1.5 cm., was found in the wall of the stomach on the greater curvature, about $1^1/_2$ inches from the pylorus. It appeared to lie within the wall but did not extend into the mucosa. Frozen section revealed aberrant pancreatic tissue, which was locally excised.

Note: A benign intramural lesion was correctly suggested by a radiology resident who had been alerted to the existence of aberrant pancreatic tissue and acquainted with its morphology. He included aberrant pancreas among the possibilities.

CASE VII: G. W., a 40-year-old Negro male, entered the hospital with a history of recurrent attacks of upper abdominal pain which seemed to radiate into the entire abdomen. These lasted for varying periods of time and subsided spontaneously. They had been present for an indefinite number of years. In the two weeks before admission the patient had suffered from left upper quadrant pain. He complained also of weakness for the past year. There was a history of amebiasis during military service.

Findings on physical examination and routine laboratory studies were normal, as was a gastroscopic examination. A gastro-intestinal series (Fig. 9) revealed a circular area of translucency in the prepyloric region on the greater curvature border,

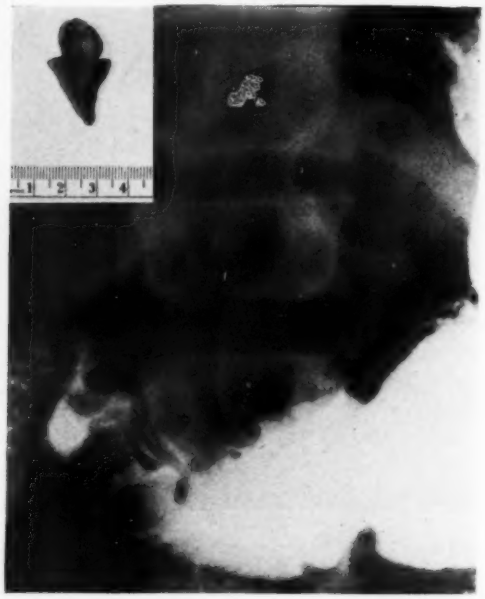

Fig. 9. Case VII. A circular area of translucency in the prepyloric region. The inset shows a polyp corresponding to the filling defect. Pancreatic ducts were found in its stalk.

approximately 1.5 cm. in diameter and smoothly contoured. Review of films obtained a year earlier showed an identical defect, which had been overlooked. It was believed to be a polyp or other benign tumor.

An exploratory laparotomy revealed a single gastric polyp (Fig. 9, inset), 1.5 cm. in diameter, on the anterior wall of the greater curvature 3 cm. from the pylorus. It was easily palpated through the stomach wall and there was a slight whitening of the serosa over the base. The surgeon stated that during episodes of distress the polyp apparently herniated through the pylorus and caused intussusception of the stomach wall. Frozen section revealed gastric mucosa in polyp formation. Microscopic study (Dr. Wm. Benner) following local excision showed "a polyp with pancreatic-like ducts in the stalk."

Note: We know of no previous case report in which a benign polyp was associated with aberrant pancreatic tissue.

DISCUSSION OF CASES

A composite picture of our cases would look about as follows: The mass of aberrant pancreatic tissue was located in the antrum within 3.5 cm. of the pyloric orifice. It was single and intramural, and from 0.5 cm. to 1.5 cm. in diameter. It was spherical, almond-shaped, or discoid. When visible, it was light, creamy, or white. The mass was palpable and finely lobulated grossly. It was usually described as a mound-like elevation with a central depression. The apex of the mound revealed a crest of mucosa outlining a centrally located pit ranging from 1 to 5 mm. in diameter (Fig. 1). This pit widened out below like a volcanic crater. Its depth varied from 0.5 to 1 cm. The aberrant pancreatic tissue lay in the submucosal connective tissue beneath the depression (Fig. 3). The ducts were often more profuse than in normal pancreas. Their arrangement was haphazard, so that in some sections they were not associated with acinar tissue.

The gross morphology as observed in our cases has been described in the literature by such terms as: a nipple with a mouth (10), umbilicated (11, 12), teat-like (12), pseudo-crater (14) diverticulum-like recess of the mucosa (1). Benner (4) prefers the term mucosal pseudo-diverticulum. We have avoided the use of that term in this paper because of its association with duodenal ulcer in the roentgen literature, although it is an excellent pathological description. We prefer the terms depression, central pit, or dimple, as being more neutral in implication. Cohen (9) described several ducts coalescing to form a large duct which opened into the umbilication. We have found no other reports of a single duct opening into the base of the mucosal depression and suspect that Cohen's report has given currency to the frequently quoted but incorrect conception that the fleck of barium in the center of the aberrant tissue lies in a pancreatic duct. We believe that the gross morphology seen in our first five cases may be frequently present, though infrequently reported. Since the opening in the depression may be minute, it may be easily overlooked, especially when obscured by tenacious mucus. It is felt that the diagnosis can be readily made by the surgeon, and inappropriate operation avoided.

It remains to be seen whether the roentgenologist can put the surgeon on his guard by warning him of the possibility of aberrant pancreatic tissue on the basis of the roentgen examination.

ROENTGEN DIAGNOSIS

It has been asserted that in no case of aberrant pancreatic tissue in the stomach has the true histopathological nature of the lesion been diagnosed prior to operation or autopsy and that in most instances the roentgen diagnosis was carcinoma (3). The Mayo group (1), however, state that the correct diagnosis was suspected in 3 of their cases. In our sixth case it was included among the possibilities because we have become quite sensitive to the existence of this lesion. Articles in the roentgen literature, after reporting errors in diagnosis, routinely conclude that ectopic pancreatic tissue should be considered in the differential diagnosis of apparently benign intramural tumors.

Our studies of aberrant pancreatic tissue with special emphasis upon its gross morphology lead us to believe that the roentgen findings may include the following characteristics:

1. *A filling defect:* The large majority of pancreatic rests will produce a nodular prominence in the gastric mucosa with a corresponding indentation and filling defect in the barium shadow. This is because most of them involve the submucosa. The minute nodules will be missed not only by the roentgenologist but in many cases by the pathologist, especially in infants. These cases, however, are usually of little clinical significance and affect only statistics regarding the frequency of the condition. In the few cases in which the lesion is subserosal, its small size will

Fig. 10. Proved leiomyosarcoma of the stomach. The mass is not only considerably larger than the usual mass of aberrant pancreatic tissue but the crater is eccentrically placed. This latter finding, however, is not invariable.

usually prevent the production of a defect in the barium shadow.

2. *Position:* The mass is usually found in the antrum, at or within 6 cm. of the pyloric orifice. While in most of our patients the curvatures were spared, this is not true of the cases from the literature as a whole. In these the lesion has been found with equal frequency on greater and lesser curvatures, and anterior and posterior walls. In the region of the pyloric orifice the mass may produce intermittent pyloric obstruction by prolapsing through the pylorus.

3. *Size:* The mass seldom exceeds 4 cm. in diameter; it is usually 1 to 2 cm. in its greatest diameter.

4. *Shape:* The shape varies from round to elliptical, but is usually oval. While pathologically the mass may be finely lobulated, this finding is rarely demonstrable on the film.

5. *Contour:* The lesion is sharply marginated as a rule.

6. *Periphery:* The uninvolved wall of the stomach has been said to form an abrupt angle with an extramucosal filling defect when viewed in profile. When the mass protrudes into the lumen like a polyp, this angle is acute (14). We have not found these criteria of much help, probably because we have not caught the defect in profile but *en face;* along the curvatures they may be of value.

7. *Central Depression:* Because of the probably frequent occurrence of a central pit, this finding is helpful when present. The diameter of the orifice has varied from 0.1 to 1.5 cm. and the depth from 0.5 to 2 cm. In profile the barium fleck caught in the dimple may bulge at its base. The central position of the barium fleck will favor a diagnosis of aberrant pancreatic tissue over an extramucosal neoplasm, for in the latter the crater is usually eccentrically placed and is likely to be irregular. Figure 10 shows a proved case of leiomyosarcoma. Not only is the mass larger than that usually seen in aberrant pancreatic tissue, but the crater is eccentric in position.

8. *Mobility:* Usually no pedicle is present. The filling defect will, therefore, be immobile. When there is a pedicle, it usually tends to be broad. There have been occasional surgical reports of prolapse of an aberrant pancreatic nodule through the pyloric orifice from a distance of 2 or 3 cm. from the orifice. In these cases a pedicle is present and the differentiation of aberrant pancreatic tissue from a prolapsed polyp, or possibly even prolapse of gastric mucosa, will be difficult.

9. *Gastric Mucous Membrane:* The mucosa over the mass tends to be stretched and thinned and is, therefore, smooth and without folds. The adjacent mucous pattern of the stomach appears normal. The stomach wall in the region of the aberrant nodule is pliable.

10. *Peristalsis:* There is seldom interference with peristaltic activity.

11. *Absence of Spasm:* There is no incisura or other evidence of spasm unless the aberrant pancreatic tissue is compli-

cated by ulcer or inflammation, or there is an adjacent ulcer.

12. *Absence of a Palpable Mass:* The mass is usually too small to be palpated through the anterior abdominal wall.

13. *Absence of Residue:* There will be no significant gastric residue unless the mass obstructs the pylorus or the distal antrum.

14. *Presence of an Adjacent Lesion:* When aberrant pancreatic tissue is contiguous to a duodenal or gastric ulcer, the resulting deformity or spasm may obscure the nodule. This happened in Case III. An overlying neoplasm may also obscure the aberrant pancreatic tissue, as in Case VII.

VALUE OF OTHER CLINICAL FINDINGS IN THE ROENTGEN DIAGNOSIS

It has been stated that aberrant pancreatic tissue is a distinct clinical entity (11), but it is generally agreed that there is no single symptom complex by which the lesion may be diagnosed (1). There is a small but distinct group in which intermittent pyloric obstruction is conspicuous. In this group we do not believe that prolapse of aberrant pancreatic tissue can be distinguished from the prolapse of a neoplasm of the antrum. The symptoms may mimic a gastric or duodenal ulcer, cholecystitis, and biliary colic, or the digestive symptoms may be indeterminate. It is when the clinical diagnosis is not clear-cut that the roentgen findings may be decisive.

The highest incidence of surgical cases is in the fourth, fifth, and sixth decades. There is no adequate explanation of why an antenatal lesion should suddenly give rise to symptoms after remaining latent for several decades. The age incidence, however, may be only a reflection of the greater number of gastro-intestinal examinations performed in older persons to rule out a malignant neoplasm.

Bleeding has been stressed as the most common constant symptom in extramucosal tumors of the stomach (14). It is uncommon in aberrant pancreatic tissue. The failure of the lesion to respond to adequate medical treatment is significant.

Gastroscopy may be an aid in diagnosis by confirming the roentgen findings. The mass will be seen to be intramural, covered by normal mucosa, and not ulcerated. When visualized, it may be thus differentiated from an ulcerating malignant epithelial neoplasm. In the 3 cases in our series in which gastroscopy was used, the mass was not seen.

DIFFERENTIAL DIAGNOSIS

1. *Polyp:* Aberrant pancreatic tissue in the stomach is more commonly mistaken for a polyp than for any other lesion. In our experience the diagnosis of polyp is made too often by the roentgenologist. Bockus has stated that the cauliflower-like papilloma is comparatively rare, but malignant change is frequent. Our experience supports this statement. Most of the polyps observed in our hospital have been multiple. By the time of roentgen diagnosis, the single polyps have practically always exceeded 5 cm. in diameter and have shown malignant change. They have almost invariably been diagnosed by the roentgenologist as carcinoma. Polyps have a tendency to ulcerate and bleed. They are pedunculated and sometimes lobulated. Like aberrant pancreatic tissue, most single, small polyps are incidental autopsy findings. We readily admit, however, that a small polyp and aberrant pancreatic tissue in the region of the pyloric orifice may be indistinguishable. Here the presence of bleeding favors a diagnosis of polyp. Gastroscopy should be of help in making the diagnosis. The distinction between these two conditions is most important because any benign-appearing polyp may be malignant histologically (16).

2. *Lymphoma:* Lesions of the lymphoma group tend to involve a major portion of the stomach.

3. *Intramural Neoplasm:* Intramural neoplasms usually exceed 4 cm. in diameter and frequently lie in the fundus and body of the stomach rather than in the

antrum. They have a strong tendency to ulcerate and bleed. Their craters are eccentric. Most of the sarcomas are on the lesser curvature and posterior wall. A palpable mass is felt in approximately 40 per cent of cases because the tumors are usually bulky by the time of examination (16). If more than one intramural lesion is suggested, this would almost invariably rule out an aberrant pancreatic nodule and favor neurofibromas or myoma.

4. *Carcinoma of the Stomach:* Local resection is generally agreed to be the ideal treatment for aberrant pancreatic tissue. The inability of the surgeon to exclude a malignant neoplasm has often compelled him to perform radical surgery in his treatment of this benign condition. The old maxim *primum non nocere* should be borne in mind when choosing the operative procedure. Except in an occasional case in the juxtapyloric region, there is seldom any reason for confusing carcinoma with aberrant pancreatic tissue when the latter is outlined as a small punched-out defect containing a central depression with normal surrounding mucosa. This is especially true when there is no interference with gastric function.

5. *Gastric Ulcer:* A considerable number of pancreatic nodules in the stomach have been diagnosed as inflammatory, or due to ulcer. This is particularly true of examples in the juxtapyloric area. One can readily see how spasm, deformity, and significant residue can lead to such a diagnosis. The well defined round or oval defect without peripheral inflammatory infiltration usually steers the roentgenologist away from a diagnosis of ulcer even in the presence of a central barium fleck, spasm, and residue.

SUMMARY

The diagnosis of aberrant pancreatic tissue in the stomach offers a challenge to the roentgenologist. The condition is frequently clinically significant, and its recognition may serve as a guide to appropriate surgical measures.

On the basis of the gross morphology, as described by Dr. Wm. Benner, it is suggested that a correct diagnosis may be made roentgenologically in a substantial number of cases.

NOTE: Acknowledgment is made to the Medical Illustration Department of the Veterans Administration Hospital, Hines, Ill., for the reproductions used in this paper.

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Hines, Ill.

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SUMARIO

Tejido Pancreático Aberrante en el Antro Gástrico. Presentación de Siete Casos

El diagnóstico de tejido pancreático aberrante en el estómago constituye un reto al radiólogo. El estado reviste frecuentemente importancia clínica, y su reconocimiento puede servir para orientar las medidas quirúrgicas procedentes. A base de la morfología macroscópica, parece que cabe hacer roentgenológicamente el diagnóstico acertado en un número substancial de casos.

El tejido pancreático aberrante en el estómago suele tomar la forma de una eminencia nodular en la mucosa gástrica con la indentación y nicho correspondientes en la sombra de bario. El asiento habitual es en el antro, a 6 cm. o menos del orificio pilórico.

La tumefacción rara vez excede de 4 cm. de diámetro y suele tomar forma oval, con contornos netamente marginados. Existe a menudo una depresión central de 0.1 a 1.5 cm. de diámetro y 0.5 a 2.0 cm. de profundidad, en la que puede distinguirse un copo de bario. Este último hallazgo toma mucha importancia. La mucosa sobrepuesta a la masa de tejido aberrante es lisa y no tiene pliegues. Muy raramente hay un pedículo presente.

Hereditary Multiple Exostoses[1]

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HEREDITARY multiple exostoses is a familial disturbance in the growth of cartilaginous bone tissue, most marked at the diaphyso-epiphyseal junction of the long bones. Until the report of Ehrenfried (1) in 1917, mention of this disease was relatively infrequent in the American literature, but since that time numerous cases have been reported (2). In a review of the American literature prior to his publication, Ehrenfried was able to find 71 cases, to which he added 12 cases of his own. His contribution was to bring this condition to the attention of the medical profession in this country.

The nomenclature is confusing. In Britain, where the disease was popularized by Keith (6), it is referred to as "diaphyseal aclasia." Ehrenfried and others in this country preferred "hereditary deforming chondrodysplasia," a vague term which does not describe the actual findings. "Hereditary multiple exostoses," as proposed by Jaffe (3), appears to give the most accurate description of the disorder and because of its simplicity seems to be a practical designation. Caffey (4), in his most recent book on x-ray diagnosis, refers to this condition as "chondromatosis" but gives "hereditary multiple exostoses" as a synonym. The use of the term "dyschondroplasia" in this connection is unfortunate, since, as originally used by Ollier, it referred only to cases of unilateral skeletal enchondromatosis.

Jaffe, who based his paper on the study of 28 cases, feels that hereditary multiple exostoses is not as rare as the literature would lead us to believe. Undoubtedly many cases are not discovered, since there are no lethal factors involved and this disorder does not affect the fetus in its development. It is extremely unusual for a newborn infant to manifest any signs of the disease. Usually it appears in early childhood and is discovered only by accident.

The incidence of hereditary multiple exostoses is variable, but most authors agree that it occurs more often in males. Ehrenfried gives the ratio of males to females as about 3 to 1. In the chapter on genetics in the *Text book of Pediatrics* by Mitchell-Nelson (8), transmission through the female, though rare, is mentioned. Ehrenfried's analysis according to nationality, showed 60 per cent of the cases reported in the German literature, 27 per cent in the French, and 8 per cent in the English, leaving only 5 per cent to be accounted for in the literature of other countries. Cases in Negroes have been reported.

The lesions of multiple exostoses are more readily demonstrated by x-rays than by clinical methods. The long bones are chiefly affected, especially of the lower extremities. One usually finds the lesions arranged bilaterally and symmetrically, but cases have been described in which one side of the body seems to be the site of predilection. The skull may occasionally contain some lesions because it is preformed in cartilage, but usually it is not involved. The bodies of the ribs may show some pointed exostoses, especially at the chondral ends. Rows of flat knob-like lesions may frequently be noted on the scapulae, and similar prominences may occur on the innominate bones.

As was stated previously, the disorder is most manifest in the tubular bones of the lower extremities. The most common site of involvement seems to be the knees. There may be synostoses or interlocking exostoses at the distal ends of the fibula and tibia. While in the humeri the upper

[1] From the X-Ray and Pediatric Services of Gouverneur Hospital, New York University-Bellevue Medical Center. Accepted for publication in November 1951.

Fig. 1. Case I: Changes in the upper and lower extremities of the mother.

ends of the shafts are most often involved, in the forearm the lower ends of the ulnae and radii are the sites of lesions rather than the area closer to the elbow joints.

There are two schools of thought concerning the pathogenesis of hereditary multiple exostoses. One maintains that the lesions originate from the epiphyseal cartilage and bone, whereas the other holds that the origin is from the coverings of the shaft and the epiphyseal junction. Each of these theories has many adherents and Jacobson (5) has done some investigative work along this line.

Hereditary multiple exostoses requires no treatment except in the presence of symptoms. The evolution of new exostoses, as well as their continued growth, usually ceases when the patient reaches adult life, though occasionally lesions will suddenly begin to enlarge rapidly after that time. It is for these lesions that Coley (7) advises intervention. He states that wide excision is indicated, because the trauma from inadequate surgery may in itself cause malignant alteration. These bony tumors, like many other of the benign tumors, can become malignant, but this usually occurs in adult life.

CASE REPORTS

CASE I: M. F., a female aged 29 years, gave a history of multiple bony swellings since childhood. She stated that no other member of her family had ever complained of a similar disorder. Of her 4 children, the first, a male, was alive and well, with no evidence of exostoses. The second, also a male, died at one month of age, with multiple congenital defects. The other two children are our second and third cases.

Roentgenograms revealed exostoses of various types on both scapulae, both clavicles, the proximal half of the shaft of each humerus, the distal ends of the shafts of the right ulna and left radius, the condylar regions of both femora, and the proximal and distal ends of both tibiae and fibulae. Most sessile lesions were noted at the distal ends of the femora. Partial synostosis had occurred at the distal ends of the tibiae and fibulae, due to pressure and fusion.

CASE II: J. F., a boy of six years, son of the patient described above (Case I), was brought to the Out-Patient Department with his sister (Case III), because of multiple bony swellings. He had been born at term, with normal spontaneous delivery after a sixteen-hour labor. The birth weight was 7 1/2 pounds. The child sat at six months, stood at ten months, and walked at seventeen months. Dentition occurred at six months. Bony swellings were first noticed at three years of age, at the knees and

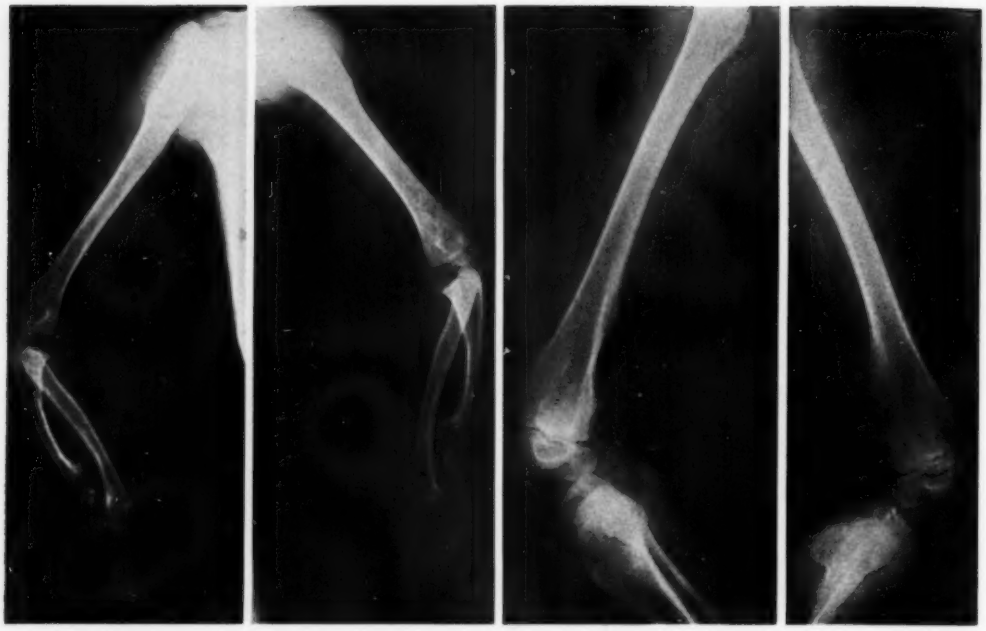

Fig. 2. Case II. Note particularly the flared, cystic, distal ends of both ulnae.

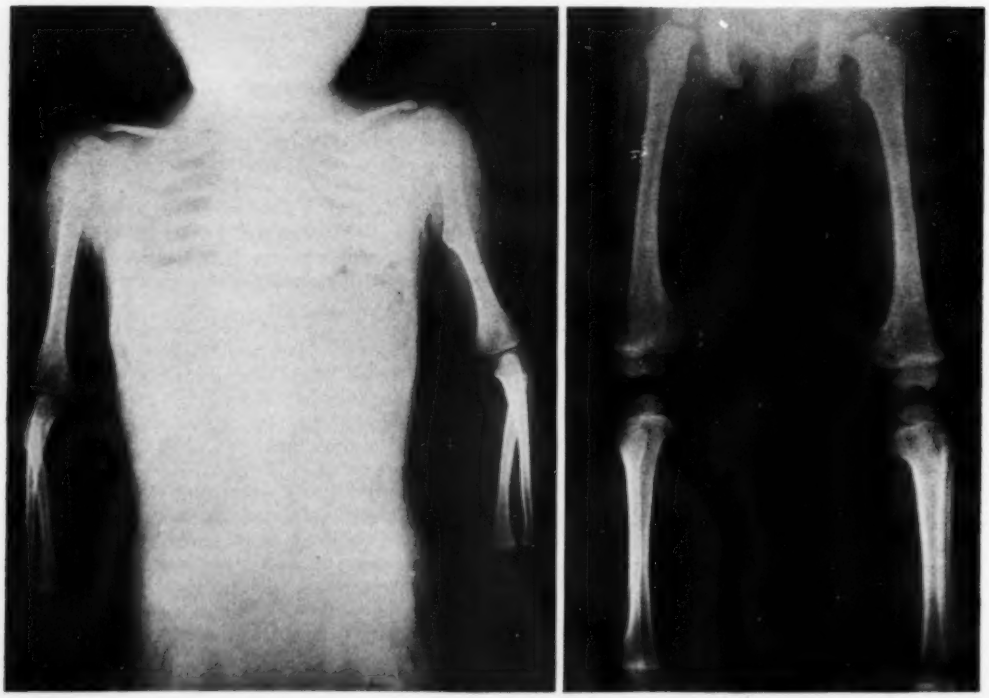

Fig. 3. Case III. The exostoses are not pedunculated. Note especially the broad-based lesion on the shaft of the left humerus

right wrist. Occasionally the child complained of pain in his lower legs and feet, but none of the bony swellings had broken through the skin. There was no history of trauma over the sites where exostoses had formed.

Physical examination showed exostoses of the third left rib, the distal end of the right radius, the distal ends of both femora, the distal ends of both tibiae and fibulae, and the proximal end of the right tibia. Roentgen studies revealed exostoses of various types on the third left rib, the proximal ends of both humeri, the proximal ends of both ulnae, the distal ends of both radii and ulnae, the distal ends of both femora, the proximal ends of both tibiae and fibulae, the distal ends of both tibiae, and at the base of the right os calcis. The distal ends of both ulnae were flared in shape, cystic in appearance, and shortened, giving the appearance of bowing.

CASE III: G. F., a two-year-old girl, sister of the patient just described, was first noted to have bony swellings on the left upper arm and the left hand and wrist at approximately six weeks prior to her being seen in the Out-Patient Department. Her history was as follows: normal spontaneous delivery after two and a half hours of labor; birth weight 6 1/2 pounds. She sat at six months, stood at nine months, walked at seventeen months, and had teeth at five months.

Physical examination revealed prominence of the glabella, ten exostoses palpable on the left side of the thoracic cage, a large single exostosis on the left humerus, and a small one on the distal end of the right radius. This patient did not show the variety of pedunculated forms seen in her mother and brother. A large single broad-based lesion was noted on the middle of the shaft of the left humerus, a broad-based exostosis on the neck of the right radius, and at the distal end of the right tibia. Changes almost cystic in type were demonstrable at the distal ends of both femora and the proximal ends of the fibulae.

COMMENT

Three cases of multiple exostoses have been reported, occurring in one family—a mother and two of her four children. In most of the reported cases, the disease appears to have been transmitted through the male, but in this family it was probably the mother who transmitted the condition to her children. Radiographic examination of the father, done elsewhere, revealed no exostoses.

The ages of the children may be slightly unusual, since the condition is rarely discovered before the age of ten to twelve years, if at all before adult life.

We believe that hereditary multiple exostoses may be encountered more frequently and much earlier than has been previously reported.

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SUMARIO

Exostosis Múltiples Hereditarias

Los 3 casos presentados de exostosis múltiples hereditarias eran en una madre y dos de sus hijos. Aunque la mayor parte de los casos de este trastorno que se han descrito parecen haber sido transmitidos por el varón, en esta familia la transmisión había tenido lugar aparentemente a través de la madre.

En los niños, el estado fué descubierto a una edad algo más temprana que la comunicada habitualmente, o sea de dos y tres años, respectivamente.

Paradoxical Expiratory Ballooning of the Hypopharynx in Siblings with Bilateral Choanal Atresia[1]

WALTER M. WHITEHOUSE, M.D., and JOHN F. HOLT, M.D.

ATRESIA OF THE posterior choanae is a relatively rare congenital anomaly, cases of which may be classified as unilateral or bilateral, complete or incomplete, and membranous, osseous, or mixed. The majority of patients with this disorder are said to have osseous obstruction, with thickness of bone varying from a few millimeters to more than 12 millimeters. The central portion of the obstruction is usually thinner and may be membranous. To explain the abnormality on a developmental basis, persistence of the bucconasal membrane is postulated. This structure usually ruptures in the thirty-five-day to thirty-eight-day embryo, forming the primitive choanae. Persistence of the portion of the buccopharyngeal membrane above the palate is suggested as a secondary cause, while a third possibility offered is overgrowth of the vertical and horizontal palatal processes. A familial incidence has been reported (1–6).

Roentgen studies of choanal atresia usually emphasize demonstration of the obstruction by a contrast medium in the nasal cavity (7) and the finding of abnormal bony structures (Fig. 1). The authors, however, recently had an opportunity of making some interesting fluoroscopic observations on two brothers with complete bilateral choanal atresia, in whom the paradoxical distention of the hypopharynx during expiration was so striking that it was deemed worthy of report. The embryological aspects of these cases are to be discussed elsewhere by our colleagues in otolaryngology (8).

In the normal infant and in early childhood, as pointed out by Pancoast (9), "during the inspiratory phase the pharynx is often filled with air and the post-pharyngeal space is comparatively narrow.

Fig. 1. Iodized oil in nares of a 4-year-old boy with choanal atresia, showing complete obstruction posteriorly.

During expiration the space may be much wider, when the pharyngeal space is completely or partially collapsed." Hay (10) also emphasized the presence of air in the pharynx in the inspiratory phase, and his excellent illustrations demonstrate the relative distention of the hypopharynx during inspiration, in contrast to its collapse during expiration. The disturbance of the mechanics of respiration in our cases of complete bilateral atresia was productive of a striking reversal of these normal findings.

CASE I: The patient was a male infant born at term Aug. 28, 1950, with normal vaginal delivery after a short labor. He cried soon after birth, but in a few minutes stopped breathing and an airway was introduced. His hands and feet were cyanotic at that time. He experienced considerable difficulty in eating and was kept in an oxygen tent most of the time. A diagnosis of posterior choanal atresia was made, and the possibility of an associated congenital anomaly of the heart was also considered.

[1] From the Department of Roentgenology, University of Michigan Hospital, Ann Arbor, Mich. Originally accepted for publication in October 1951. Revised in March 1952.

At the age of four weeks, the child was transferred to the University Hospital for further treatment. On examination, he appeared dehydrated and moderately cyanotic, with marked respiratory distress. There was some overlap of the right parietal and occipital bones. The anterior fontanelle measured 3.5 × 2.5 cm. and was not tense. There was a yellow purulent discharge from the left nostril. The infant breathed with the mouth open and rested in a somewhat opisthotonus position, with the head far back, in an apparent attempt to improve respiration. A probe could not be passed beyond an evident bony plate in the region of the posterior nares bilaterally. The heart rate was 132, with normal sinus rhythm. A loud harsh systolic murmur was heard over the entire precordium, with a questionable diastolic component. There was an incomplete cleft of the left upper lip without alveolar or palatal cleft. No other abnormality was present.

Fluoroscopically the chest showed no abnormality. No air column could be demonstrated above the level of the soft palate. Unquestionably, the most unusual and interesting feature was the pronounced ballooning of the hypopharynx which was a constant feature of every expiratory effort, followed by collapse on inspiration. Attempted lipiodol filling failed to demonstrate the upper esophagus, but did outline the hypopharynx to good advantage. Multiple spot films were made of the chest and soft tissues of the neck, the latter in both inspiration and expiration. The examination was terminated because of the patient's need for oxygen, and he was returned to the incubator.

Spot films confirmed the fluoroscopic findings, demonstrating the unusual ballooning of the hypopharynx during expiration as well as the collapse during inspiration (Fig. 2, A and B). No air column was seen above the level of the palate, and the hard palate appeared to extend to the posterior nasopharyngeal wall.

Following fluoroscopy, a small metal airway was introduced. Dramatic relief of the respiratory difficulty ensued immediately, and it was found that the infant could be taken out of oxygen without recurrence of cyanosis or respiratory distress.

On October 2 surgical opening of the posterior nares was performed and a rather thick and resistant plate of bone was found occluding each choana. These osseous plates were perforated and the openings enlarged with punch forceps. Probing showed that the nasal septum extended to the posterior nasopharyngeal wall and this structure also was perforated and removed with punch forceps.

Respiratory distress continued postoperatively, and a second surgical attack on the horizontal bony plate extending posteriorly from the hard palate was undertaken on October 20. This was found to obstruct the nasopharynx completely in the horizontal plane except for a small hole, 0.5 × 0.25 cm., at the posterior margin of the hard palate. There was periosteal but not bony fusion with the posterior

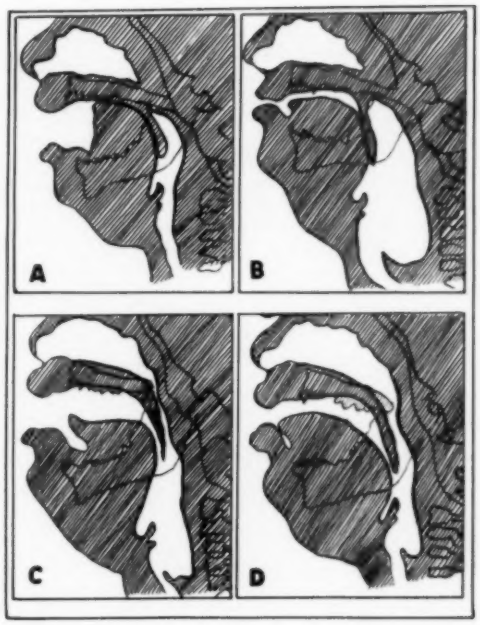

Fig. 2. Case I. A. Tracing of spot film made during initial fluoroscopy, showing relative collapse of hypopharynx on inspiration.

B. Marked paradoxical expiratory ballooning of hypopharynx.

C. Tracing of spot film made during final fluoroscopy, showing reversion to normal slight distention on inspiration.

D. Reversion to normal relative collapse on expiration.

nasopharyngeal wall. The bony plate was removed and the subsequent exposure made possible a more complete removal of the remaining ridge of cartilage where the nasal septum had extended posteriorly to the wall of the nasopharynx. Following this second operative procedure, there was improvement in both respiration and feeding, and by November 2 it was considered possible to undertake a cheilorraphy. This was done uneventfully and the infant was discharged on November 10.

After discharge the patient at first showed no evidence of nasal obstruction except when excited. Within several days, however, he rejected his bottle to gasp for air, and progressive difficulty in feeding followed. The family physician was unable to pass a nasal catheter on either side of the nose, and the child was readmitted on November 21. At that time there was obstruction of the nasal airway bilaterally with only slight bubbling of mucus outward during expiration, indicating possibly very slight patency of the choanae. Respiration was difficult, with rattling expiratory efforts. It was felt that there was cicatricial contracture of the posterior choanae and that further attempts at opening should be postponed. A transection of the soft palate was recommended to provide sufficient

Fig. 3. Case II. Iodized oil in nares showing complete choanal obstruction. Fluoroscopy of the hypopharynx showed respiratory changes similar to those in Case I (Fig. 2). Moderate expiratory distention of the hypopharynx can be seen in B.

airway until the choanae could be reopened. This was done on December 11. Following this procedure the child improved considerably in respiration and feeding, though he still could not breathe through his nose. There was some fluctuation of nasal mucous secretions, however, suggesting the presence of small choanal openings.

On check-up examination, March 19, 1951, fluoroscopy showed an essentially normal contour of the hypopharynx, with normal distention on inspiration and decrease in size with expiration (Fig. 2, C and D). This constituted a reversal of the paradoxical distention of the hypopharynx on expiration originally seen. Films also showed evidence of removal of the horizontal bony plate, but the nasal cavity did not contain the normal air column.

CASE II: The second patient was the next sibling in the same family, a male infant born on Jan. 18, 1952, at term, with a birth weight of 6 lb. 8 oz. This was the mother's third pregnancy. About one hour after birth it was noted that the child was "blue." He did not feed well; only one-half ounce of liquid was taken and this was followed by coughing, dyspnea, and cyanosis. One normal neonatal stool was passed. Because of continued inability to eat, dehydration, and weight loss, the child was transferred to the University Hospital on January 21, at three days of age.

The family history showed that the mother and father were well. The older brother (Case I) was said to be enjoying an excellent result from his surgical treatment for posterior choanal atresia and was walking and talking at eighteen months. A sister, aged four, was entirely normal.

Examination on admission showed the pulse to be 140, the temperature 99.4°, the respiratory rate 40, and the blood pressure 70/40. The infant seemed dehydrated and occasionally cyanotic. The head was 14 inches in diameter and without local tenderness. The lower jaw receded somewhat. The left lid lagged slightly; the pupils reacted normally. Breathing appeared to be easier with the head extended and mouth open. The nasal septum was in the midline. No nasal exudate was noted. The examiner was unable to pass a catheter through the nose into the pharynx. The mouth and neck appeared normal. There were coarse moist expiratory râles after feeding, but the lungs were otherwise clear. The heart was negative. The genitalia and rectum were normal to examination. The extremities were normal and the reflexes physiologic The skin was dry and loose.

Fluoroscopy revealed no abnormality in the chest, but the hypopharynx showed paradoxical distention with each expiratory effort. The respirations were somewhat irregular. At the beginning of expiration, the soft palate and uvula were seen approximating the surface of the base of the tongue, creating an effective valve delaying the escape of expired air from the hypopharynx. The hard palate

appeared to extend to the posterior pharyngeal wall. On inspiration, the distended hypopharynx was seen to collapse. Instillation of lipiodol was then done in one side of the nose at a time. Complete block was noted at the level of the posterior nares bilaterally. Spot films confirmed the screen findings, and additional routine films were made with the lipiodol still present in the nasal cavities (Fig. 3). The complete block at the level of the posterior nares was well demonstrated, as was the apparent extension of the hard palate to the posterior pharyngeal wall. The paradoxical distention of the hypopharynx is seen in Figure 3, but the exact status of the posterior border of the nasal septum cannot be determined from these films.

It was the original opinion of the otologists that, if conservative measures could keep the patient in good condition, surgical correction of the atresia should be postponed until he was five or six months of age. Difficulty in feeding and repeated abdominal distention due to swallowing of air, however, prompted immediate operation. The bony plate at the left posterior choana was removed and a small plastic tube inserted to prevent cicatricial closure. Extension of the hard palate posteriorly was not found. The patient withstood the operative procedure well and his respiration improved.

Fluoroscopy on the third postoperative day showed paradoxical distention of the hypopharynx at the onset of the expiratory effort, rapidly decreasing as air was expired through the nasal tube. The hypopharynx collapsed on inspiration. This was in marked contrast to the preoperative fluoroscopic appearance, with distention throughout almost the entire expiratory effort, and was thought to indicate a significant decrease in the expiratory block, without complete return to normal.

DISCUSSION

The paradoxical expiratory ballooning of the hypopharynx observed in the initial fluoroscopic examination in each of the two cases presented was obviously due to expiratory block at the respiratory outlets of the pharynx. This block has two elements, relief of either of which provides an air passage. The first is the choanal and nasopharyngeal bony atresia; the second is the approximation of the soft palate and the tongue on expiration, effectively creating by valve action a blind pouch against which the expiratory effort is made. In the first case, the resection of the choanal and post-palatal bony plates provided sufficient airway for temporary relief of the expiratory block. Postoperative cicatricial choanal closure, however, caused a return of respiratory difficulty. Recognition of the second factor, namely the effect of the approximated tongue and palatal curtain, led to subsequent section of the soft palate to provide sufficient airway until further growth of the child should permit choanal reoperation.

In the second case the distention of the hypopharynx was not as great, indicating some escape of expired air around the soft palate and through the mouth. Respiratory distress and cyanosis were considerably less than in Case I. Fluoroscopy after unilateral repair showed partial but not complete relief of the expiratory block, with persistence—though to a lesser degree—of the reversal of the respiratory dynamics of the hypopharynx.

The rarity of this anomaly prevents us from extending these fluoroscopic studies to other cases. It seems reasonable, however, that the degree of expiratory occlusion produced by the approximation of the soft palate and tongue may well vary in different cases of complete choanal atresia, and that the degree of paradoxical expiratory distention of the hypopharynx would therefore vary. Different degrees of incompleteness of the atresia would also cause variations in the paradoxical expiratory distention. Fluoroscopic observation of the pharynx will then yield an index of the completeness of the expiratory block as well as indicating the urgency for an airway. Relief of the ineffectual expiratory effort, as in Case I, may be accomplished by an airway separating the approximated tongue and soft palate until definitive surgical measures may be undertaken.

CONCLUSIONS

1. Two cases of bilateral choanal atresia are reported, occurring in male siblings in consecutive pregnancies.

2. Fluoroscopic observations showed paradoxical expiratory ballooning of the hypopharynx and its collapse on inspiration.

3. In addition to the choanal atresia, approximation of the soft palate and tongue

on expiration is a contributing factor in producing varying degrees of expiratory block.

4. From the standpoint of the altered respiratory dynamics, the degree of expiratory ballooning of the hypopharynx is an index of the degree of expiratory block and of the probability of relief of such a block by insertion of an airway pending definitive surgical measures.

5. Fluoroscopy of the pharynx in the preoperative and postoperative evaluation of cases of choanal atresia is recommended as a valuable adjunctive procedure.

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SUMARIO

Inflación Expiratoria Paradójica de la Hipofaringe en Hermanos Carnales con Atresia Coanal Bilateral

Los 2 casos de atresia coanal bilateral aquí presentados ocurrieron en hermanos carnales nacidos en partos consecutivos. Las observaciones roentgenoscópicas revelaron abombamiento paradójico de la hipofaringe a la expiración y aplastamiento de la misma a la inspiración.

Además de la atresia coanal, la aproximación del paladar blando y de la lengua a la expiración representa un factor contribuyente en la producción de más o menos intenso bloqueo expiratorio.

Desde el punto de vista de la alterada dinámica respiratoria, la intensidad de la inflación hipofaríngea a la expiración ofrece un índice de la intensidad del bloqueo expiratorio y de las probabilidades de alivio del mismo mediante la introducción de un ventilador hasta llevar a cabo las providencias quirúrgicas definitivas.

Como valioso procedimiento coadyuvante, recomiéndase la fluoroscopia de la faringe en la justipreciación pre- y posto peratoria de los casos de atresia coanal.

Hodgkin's Disease: A Statistical Report[1]

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HODGKIN'S DISEASE is perhaps the most controversial of the conditions listed as neoplasms of the reticulo-endothelial system. Authorities are not in agreement at this time as to whether it is a true neoplasm or a granuloma. It often behaves as a systemic infection, although it is generally accepted as a form of new growth.

This disease was first described in 1832, by Hodgkin (3), who presented seven cases. Since that time reports of its occurrence have been found with ever increasing frequency in the world literature. The mere number of the reports attests to the undecided etiology, confusing pathological picture, and unpredictable course of this condition.

The first sign of Hodgkin's disease is usually a painless enlargement of a group of lymph nodes, though practically every organ of the body has been cited as an apparent primary site. Later in the course other groups of nodes become involved, and terminally there may be generalized lymphadenopathy as well as local infiltration and distant spread to liver, spleen, lungs, and bones. A severe anemia is not unusual. Frequently a pyrexia develops at some time during the course, resulting in a remitting temperature curve believed by many authorities to be somewhat characteristic of the disease. The original temperature chart of a patient with Hodgkin's disease was published by Ebstein (2) in 1887.

The primary purpose of the study to be reported here was to evaluate the results of treatment for Hodgkin's disease at the Shreveport Charity Hospital so as to be in a position to offer the best type of palliation in the future. Admittedly, results thus far have been poor, but we feel that early diagnosis, a more optimistic attitude toward prognosis, and early institution of moderately intensive treatment might go far toward improving future statistics.

This report covers 72 cases of Hodgkin's disease diagnosed over a period of nineteen years. Only cases having a proved incisional histopathological diagnosis are included. The diagnosis was made from autopsy specimens in 2 cases and from a surgically removed stomach in another. In these 3 cases the diagnosis had not been suspected. No attempt has been made to subdivide the cases on the basis of certain characteristic microscopic findings in an attempt to predict a clinical course, as has been done by Jackson and Parker (4), Bersack (1), and others.

In this series the youngest patient was four years old and the eldest eighty-three. In agreement with others, the ratio of males to females was 2:1, or 51 males to 21 females. There were 30 white patients to 42 colored in spite of the fact that two-thirds of the patients seen at this institution are colored. All were from the northern part of Louisiana, and all were indigent. The age distribution was as follows:

Decade	Cases
1st	6
2nd	10
3rd	10
4th	12
5th	10
6th	7
7th	10
8th	4
9th	3

Since the survival figures are directly related to the extent of disease at the time of diagnosis, it was felt that a simple clinical classification was in order. The cases are therefore divided into localized and generalized disease. Initially an attempt was

[1] From the Department of Radiology and Tumor Clinic, Shreveport Charity Hospital, Shreveport, La. Accepted for publication in November 1951.

made at staging, with three separate groups, namely, Stage I, or localized disease; Stage II, an intermediate group; Stage III, or generalized disease. This we felt was important not only for consideration in planning treatment but also for computing survival rates. It was found, however, that the end-results for Stage II and Stage III were so nearly the same that it was impractical to consider Stage II as a separate group. We do feel, however, that the management of a case manifested by involvement of two separate lymph node regions and not clearly generalized should be handled therapeutically as localized disease with moderately intensive x-ray therapy to the involved areas.

The average duration of symptoms was four months. Almost invariably the presenting symptom was painless enlargement of a group of lymph nodes with the cervical group by far the most frequent site of primary involvement. Of the 72 cases here reported, 16 were localized and in 56 involvement was found to be generalized.

Treatment of these cases primarily was based upon x-ray therapy, although chemotherapy in the form of nitrogen mustard and surgery were used when deemed advisable as evidenced by the stage of disease and recurrences. Nitrogen mustard was given exclusively in only 1 case. A combination of roentgen therapy and nitrogen mustard was used in 6 cases. Only 1 patient had surgery alone, while 7 patients received a combination of surgery and irradiation. Symptomatic treatment or none at all was used in 9 cases, which were either terminal or deserted when first seen. These cases are not included in the survival figures. The remaining 48 patients were treated entirely by roentgen irradiation.

Radiation therapy was of two general types, namely, treatment of the peripheral manifestations of the disease and total-body irradiation. The latter was usually reserved for generalized disease. In general, prior to 1940, the dosage for localized therapy seldom exceeded 800 r in air by the fractionated technic. In the period 1940–45 the total dosage was in the neighborhood of 1,200 r. Since 1945 the dosage has usually been carried to a total of 2,000 r in air, with the following factors: 200 kv., 0.5 mm. Cu plus 1 mm. Al filter, 50 cm. target-skin distance, half-value layer 1.0 mm. Cu. At the present time we are using Sgalitzer's method of total-body roentgen therapy, in which the patient is given a total of 150 r to the anterior and posterior aspects of the body, with 250 kv., 0.5 mm. Cu plus 1 mm. Al filter, and 150 cm. distance. With this technic the dosage rate is 14 r per minute. A dosage of 25 roentgens is administered daily, alternately to the anterior and posterior aspects, until a total of 75 r to each has been reached. This is repeated after a week of rest. The blood count is closely followed during therapy and for several weeks following completion.

The integral dosage with this method for the patient of average size is high but does not exceed tolerance. The concentration of ionization effect is not sufficient for sterilization of localized disease, but in our hands this method has offered most in the way of palliation of generalized disease. Usually visceral infiltration as seen in the lungs will regress somewhat; the patient, previously bedfast, will often become afebrile and regain sufficient strength to be up and around. Pleural and peritoneal effusions have decreased in amount and frequency. Anemia and leukopenia, often present in generalized Hodgkin's disease, are further increased by total body irradiation, but we have thus far always been able to keep the blood level within safe bounds by whole blood transfusions. No permanent damage to the hemopoietic system has been observed. The differentiation between irradiation sickness and the symptoms of generalized Hodgkin's disease represents a challenge.

In order to simplify the computing of the survival time the treated patients with adequate follow-up in this series have been divided into two groups. Group A consists of 42 cases observed for a period of five years or longer. Group B is composed of 15 cases followed less than five years.

TABLE I: SURVIVALS IN 42 CASES DIAGNOSED IN 1932–1947 (GROUP A)

Lived less than 6 months	18 (42.8%)
Lived 7–12 months	5 (11.9%)
Lived 13–24 months	5 (11.9%)
Lived 2–3 years	4 (9.5%)
Lived 3–5 years	4 (9.5%)
Lived more than 5 years	6 (14.3%)

Five patients lost to follow-up are presumed dead but are not included in computing the percentage of survivors. Another 10 cases receiving symptomatic treatment, or none at all, are also omitted. Table I shows the survival figures for the 42 cases composing Group A.

Of the 42 patients with Hodgkin's diagnosed in the years 1932–47, 5 are known to be living at this time with apparent control of the disease. These 5 have an average length of survival of seven years and three months.

In making an analysis of the 42 cases seen prior to 1947, and covering a fifteen-year period, the survival rate according to extent of the disease has been determined as shown in Table II.

The greatest mortality in the shortest period of time, *i.e.*, less than six months after the diagnosis was made, is seen in generalized disease. The longest survival for the series was that of a patient with generalized involvement, but this represents only 2.4 per cent of the total. A 25.0 per cent five- to ten-year survival was obtained in the group with localized disease.

Group B is composed of 15 cases diagnosed in the years 1947–51 and, therefore, with a follow-up period of less than five years. Table III presents the survival rates for these patients.

TABLE III: SURVIVALS IN 15 CASES DIAGNOSED IN 1947–1951 (GROUP B)

Lived less than 6 months	4 (26.6%)
Lived 7–12 months	2 (13.3%)
Alive at present time	9 (60.0%)

Of the entire treated group of 57 patients, 22 (38.6 per cent) lived less than six months, while only 28 (49.1 per cent) lived longer than one year. The percentage of five-year survivals for the cases diagnosed before 1947 is 14.3 per cent. The over-all picture indicates an upward trend in survivals throughout the past nineteen years. We feel that the relatively intensive irradiation of the past ten years is far superior to the moderate therapy given in earlier years covered in this report.

A reasonable prolongation of life may be offered the patient with Hodgkin's disease by exercising good judgment in administering radiotherapy. Poor judgment can result only in very limited palliation. At this hospital in the years prior to 1940, it was the custom to give these patients moderate or negligible amounts of irradiation on the theory that the disease was highly radiosensitive, with a definite likelihood of recurrence that would require repeated treatment. The result was failure to sterilize the lymphadenopathy locally, with early recurrence at the treated sites at the same time that other areas of involvement made their appearance. In this event, the course was usually rapidly downhill.

Nitrogen mustard was given in only 7 cases. Obviously this is too small a series upon which to base conclusions, but it was our impression that the use of nitrogen mustard added little to the survival time.

Patients in this hospital are given the

TABLE II: SURVIVAL ACCORDING TO STAGE OF DISEASE IN 42 CASES, 1932–1947

	No. Cases	0–6 mo.	7–12 mo.	1–2 yr.	2–3 yr.	3–5 yr.	5–10 yr.	10–15 yr.
Localized disease	12	3	1	2	2	1	3	.....
		25.0%	8.3%	16.6%	16.6%	8.3%	25.0%	.....
Generalized disease	30	15	4	3	3	2	2	1
		50.0%	13.3%	10.0%	10.0%	6.6%	6.6%	3.3%

benefit of surgical, medical, pathological, and radiological consultations at daily tumor clinics and weekly tumor conferences. Since this is a charity institution, each patient has the advantage of unlimited stay in the hospital, any accepted drugs, and whatever radiological or surgical therapy is deemed necessary. In spite of this, there is a sharp contrast between our results and those of others (5–9). This can be explained partially by the very high percentage of patients with far-advanced disease seeking medical care for the first time. It is probably unfair to attempt a comparison with results at other radiotherapy centers without knowing the clinical stage of all cases concerned.

While the over-all picture of Hodgkin's disease is dark, it is not necessarily one of despair. We hope for further advances in the fields of radiation physics and chemotherapy but are primarily concerned with early diagnosis and how best to palliate with conventional therapy. It appears that a great deal more may be accomplished with the armamentarium now available than has been accomplished in the past.

SUMMARY

Seventy-two cases with a histopathological diagnosis of Hodgkin's disease seen over a nineteen-year period at the Shreveport Charity Hospital are presented. Radiation and other forms of therapy given at this hospital during the years included in the report are briefly discussed. Of 42 patients, representing all stages of the disease, in which diagnosis was made prior to 1947, 18 (42.8 per cent) lived less than six months. Only 6 (14.3 per cent) survived five years or longer. Five of these were free of demonstrable disease at the time of this report. Of 15 patients in whom the diagnosis was made after 1947, 4 (26.6 per cent) lived less than six months, 2 (13.3 per cent) lived less than a year, and 9 were still alive.

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SUMARIO

Enfermedad de Hodgkin: Informe Estadistico

Preséntanse 72 casos observados en un período de 19 años con diagnóstico histopatológico de enfermedad de Hodgkin. Repásanse sucintamente la irradiación y otras formas de terapéutica administradas durante dicho período de tiempo en el hospital del cual procede la comunicación. De 42 enfermos, que representaban todos los períodos de la dolencia, en quienes se hizo el diagnóstico antes de 1947, 18, o sea 42.8 por ciento, vivieron menos de seis meses. Sólo 6 enfermos, o sea 14.3 por ciento, sobrevivieron cinco años o más. Cinco de éstos se hallaban exentos de enfermedad observable en la fecha del informe. De 15 pacientes en quienes se hizo el diagnóstico después de 1947, 4 (26.6 por ciento) vivieron menos de seis meses, 2 (13.3 por ciento) vivieron menos de un año y 9 (60 por ciento) estaban todavía vivos.

Esos resultados indican una tendencia ascendente de las sobrevivencias y parecen justificar la conclusión de que la irradiación más intensa utilizada en los últimos diez años es superior a las dosis más moderadas administradas en los primeros años abarcados por este estudio.

Roentgen Therapy in Some Non-Malignant Conditions[1]

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PAPERS ON roentgen therapy are almost wholly concerned with malignant neoplasms. A survey of texts on treatment reveals about thirty conditions that are not malignant, which may be successfully treated by irradiation. None of these is of sufficient importance or complexity to justify a whole paper, but collectively they represent an important aspect of radiation therapeutic practice. The fact that these diseases are amenable to irradiation is familiar to radiation therapists, but is not so well known to physicians who are not radiologists. The purpose of this paper is again to call attention to a few of the more common of these diseases wherein irradiation is effective.

In the past five years the following diseases have been treated in the writer's office: furunculosis, callositas (corns), dermatitis, erythema nodosum, verruca (warts), acne, keloid, hyperhidrosis, onychomycosis, paronychia, rheumatoid spondylitis, degenerating joint disease, rheumatoid arthritis, sinusitis, lymphadenitis, adenoids, bursitis, herpes zoster, hemangioma, acute infections, pruritus ani and vulvae, granulation tissue, parotitis, and dermatophytosis, more or less successfully. Six of the commonest and those which respond best will be reviewed.

In the descriptions which follow, long wave length means rays generated at low voltage with little or no added filtration. The factors used by the writer are 100 kv., 0.25 mm. Cu inherent filter, no added filter, which gives a h.v.l. of 4.3 mm. Al.

CALLOSITAS

Probably second only to the common cold are corns as a source of human misery. While the treatment of corns may seem beneath the dignity of a serious radiation therapist, considerable relief of discomfort may be obtained by irradiation. One application of 1,000 r in air of long-wave-length radiation is usually enough for removal of a corn. The normal skin is of course carefully shielded. The pain is usually immediately relieved. In two to three weeks a mild reaction with slight pain may develop. In from four to six weeks the corn peels off. Immediate failures are rare. They are more apt to occur in old and debilitated patients. Part of the treatment is to advise that ill-fitting shoes be discarded, but as this advice is seldom followed, it probably can be dispensed with. Even with misfitting footwear recurrence within a year is rare.

VERRUCA

Only warts occurring on the hands and the soles of the feet will be considered. For these irradiation is probably the most effective method of treatment except when the wart is at the edge of the nail. Warts at this latter site are resistant to every form of treatment. Since the chance of removal by a single application of radiation is small and the temptation to retreat is strong, these should not be irradiated at all.

Another type of wart which should rarely, if ever, be treated by x-rays is that occurring on the hands of adolescents. These warts usually disappear spontaneously. As irradiation may interfere with subsequent bony growth, it should be employed only in the presence of impressive cosmetic indications or if the wart is located where repeated pressure causes pain.

Digital and manual warts in adults are very responsive to irradiation and will usually disappear after one treatment of 500 r in air of long-wave-length radi-

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

ation. If several warts are present close together, treatment of the larger one will often result in disappearance of the others. Individual treatment of each small wart is therefore not necessary at the patient's first visit.

Plantar warts are more resistant then those on the hands. It is not necessary to pare the wart. If it is surrounded with much callus, this should be included in the area treated; otherwise the wart should be closely shielded. There is great variation in the recommended dose, varying from fractional doses weekly to single doses as large as 2,500 r. The small doses are time-consuming and delay recovery. The large doses are unnecessarily severe. In a consecutive series of 243 patients with plantar warts, a single application of 1,000 r in air of long-wave-length radiation cured 87 per cent, with no significant primary reaction and no undesirable sequelae. The wart disappeared in an additional 6 per cent after a second treatment. Irradiation failed to eradicate the wart in 7 per cent.

Examination of the failures suggests that there was a failure of accurate shielding or misdirection of the beam so that the base of the wart did not receive the radiation. Most of these were very small lesions, less than 0.5 cm. in diameter.

GRANULATION TISSUE

One field in which irradiation is useful but not well known is the reduction of exuberant granulation tissue. Exuberant granulations are not uncommon in the healing of deep wounds such as mastoidectomy wounds and mastectomy scars. The young blood vessels and fibroblasts are very sensitive, more so than growing epithelium. The application of 100 r in air of long-wave-length radiation every other day for four to six applications will usually inhibit the granulations. Where this type of treatment has been used on portions of a mastectomy wound, the area treated has sometimes shown a thinner scar. This suggests that irradiation may be of assistance in the prevention of keloids.

KELOIDS

The application of 300 r in air of low-voltage unfiltered radiation will cause recession of most keloids. For those over 1.0 cm. in thickness, a second application after three weeks may be necessary if definite regression is not already observed.

Occasionally scars, with or without keloid formation, are tender or spontaneously painful. The tenderness or pain can usually be relieved by the application of 150 r in air of long-wave-length rays. If relief is not complete, the dose may be repeated in two weeks, and this is usually sufficient.

ADENOIDS

The utility of irradiation—radium or roentgen rays—in the treatment of hypertrophied lymphoid tissue in the nasopharynx is well known. It is particularly useful when the eustachian tube orifice is obstructed, where it is preferable to surgery. Roentgen irradiation is so simple and safe that it is now generally conceded to be preferable to radium.

The objective is to deliver 600 r (with back-scatter) to the nasopharynx, within ten days. This can usually be done by administering between 150 and 200 r (in air) through a right and left lateral port in three sittings. Moderately short-wave-length radiation should be used, with a half-value layer of about 1.0 mm. Cu. No reaction occurs, though there may be slight swelling of the parotid glands after the first treatment, about which the patient should be warned. Resolution of the adenoids is complete in about four weeks after the last treatment. In about 10 per cent of the patients a second course may be required. An occasional patient may be seen with a recurrence a year or more later.

ARTHRITIDES

The fact that patients suffering from rheumatoid spondylitis of the Marie-Strümpell type can be relieved of pain by irradiation is generally known. The fact

that in other types of arthritis—degenerative joint disease and rheumatoid arthritis—relief may be obtained is less widely appreciated. The empirical nature of this kind of treatment and the fact that its evaluation is subjective lead many to feel that it smacks of quackery. It seems to the writer, however, that it is justified if it is kept in mind that the only objective is the relief of pain and that no thought of cure is contemplated.

Since the treatment is not specific, classification other than chronic arthritis is unnecessary. One point is observed: the treatment is least successful in the phalangeal joints.

Small doses only are required, 100 r in air of irradiation of wave length in the neighborhood of 1.0 mm. Cu half-value layer to fields of appropriate shape and size, given twice a week for not over six applications, is adequate. In some cases relief of pain appears after the third or fourth application, in which case treatment is discontinued. If no relief is obtained after six applications, further treatment will probably be of no avail.

In the last four years, 13 patients with chronic arthritis of the spine, hips, and knees have been treated as described. In 10 there was prompt and almost complete relief of pain lasting for an average of five months. Three obtained no relief. It can be argued that these good results may be coincident with a remission. This argument cannot be successfully refuted, as the series of cases is too small and there are no adequate controls. To the writer, however, it seems that the percentage of relief is great enough to justify a trial of irradiation, to relieve the misery that these patients suffer.

SUMARIO

La Roentgenoterapia en Algunos Estados No Malignos

La roentgenoterapia ha sido utilizada con buenos resultados en los siguientes estados no malignos:

Callos: Suele ser suficiente una sola aplicación de 1,000 r al aire de rayos de onda larga.

Verrugas: Para las verrugas de las manos de las personas adultas, suelen resultar adecuados 500 r al aire de rayos de onda larga. Para las plantares, han dado buen resultado 1,000 r al aire. La irradiación está contraindicada en las verrugas del borde de las uñas y en las manos de los adolescentes.

El *tejido de granulación exuberante* puede por lo general ser reducido mediante la aplicación al aire de 100 r de rayos de onda larga cada dos días hasta cuatro a seis aplicaciones.

Queloides: La aplicación de 300 r al aire de rayos X no filtrados de bajo voltaje obtendrá la regresión de la mayor parte de los queloides.

También se ha usado la irradiación en el *tejido linfoideo hipertrofiado de la nasofaringe* y para aliviar el dolor en la *artritis*. En este último estado se administran dosis pequeñas (100 r al aire; 1.0 mm. c. h. r.), dos veces semanales a lo más hasta seis aplicaciones.

DISCUSSION

Sydney F. Thomas, M.D. (Menlo Park, Calif.): I live on the same coast as Dr. Hawley but I don't live in the same therapeutic world. I feel that x-ray therapy should never be given where there are other methods that are as good or better for the treatment of any disease. In the last five years I have seen over 25—I think it is 27—cases of radiation damage in young people treated for benign conditions. Most of these injuries were accidental, but in some the treatment was given by competent men.

I do not think that radiation should be used in the treatment of most benign conditions, especially warts on the sole of the foot, and I think that, after we listen to papers such as Dr. Stone's [see Radiology **58:** 639, 1952], we see that we are producing

an unnecessary amount of ionization in tissues that are called normal.

Let me emphasize also the familiar story of the patient with recurrent dermatosis. He is treated by you; then he goes on to Joe Doaks, but does not mention the fact that he has already been treated, and so on *ad infinitum*. While it appears to be a simple problem, it may wind up by being a very dangerous practice in the hands of the indiscriminate. I do not mean to imply that Dr. Hawley is indiscriminate, but I can't trust those who have a little Brownie camera to use.

As far as the treatment of the nasopharynx is concerned, I think we don't know the answer to that yet. I believe radiation should never be used unless there is a hearing loss and unless operative treatment has not been instituted first. Further, I do not think the course of therapy should ever be repeated. We are dealing with very young people, who may live a long, long time. The risk of post-irradiation changes is, I think, too great.

Henry P. Plenk, M.D. (Salt Lake City, Utah): I would like to congratulate Dr. Hawley for his excellent presentation and for bringing the treatment of this important group of diseases to our attention. I do not wish to detract from anything he has said but I, too, would like to offer a word of caution. If we wish to earn the respect of our colleagues in establishing therapy on a scientific basis, we should be on very solid ground in applying such a medium as x-rays, which, as Dr. Stone and Dr. Thomas have pointed out so well, is not without its hazards. We have tried to do that in various ways. In the treatment of patients with rheumatoid arthritis, we have shielded some joints and have treated others. We have produced dramatic results by this method even if x-rays never reached the shielded joints. These patients are looking for any means of getting attention and for any new method of treatment, and sometimes do very well with sham therapy. One of these sham-treated patients was later treated with ACTH, and got remarkably good results. Rigid controls are necessary for any form of radiologic treatment as well as in other fields.

I can speak with a little more authority about the treatment of bursitis of the shoulder. I had the privilege of presenting a paper on this subject before the Rocky Mountain Radiological Society last August. We have carefully controlled a small series of cases, giving some irradiation and protecting others from irradiation by means of heavy lead filters. The beneficial results in those patients who never received any x-ray therapy were very dramatic indeed.[1]

Sydney J. Hawley, M.D. (*closing*): I am glad that Dr. Thomas brought up the question of the dangers of irradiation. There may be some present. I think there is little danger in irradiation of the extremities, because the rest of the patient is protected. The amount of tissue that is being irradiated is extremely small, so that the risk of constitutional or other damage is insignificant with the doses suggested.

Dr. Thomas' mention of plantar warts is interesting. I have heard of damage following their irradiation, but have never seen any. I rather suspect that there has been a break in technic somewhere, or too many repetitions.

I have treated a large series of cases of lymphoid tissue in the nasopharynx, almost all in children, over a period of about fifteen years, and have seen no bad results—some failures, indeed, but no damage. The dosage is so small that I don't see how any damage could result.

There is, of course, some risk of constitutional damage in treating arthritides of the spine. One may give a fairly large volume dose. But here, again, the dose recommended is so small that the risk is slight. Damage may arise from over-treatment.

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[1] An account of this study will appear in Radiology for September 1952.

Segmental Localization of Pulmonary Disease on the Postero-Anterior Chest Roentgenogram[1]

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WITH THE ADVENT of bronchoscopy and bronchography and especially under the influence of modern thoracic surgery, the sublobar divisions of the lung have come to be recognized as important units. The term "bronchopulmonary segment," although applicable to any area of lung supplied by a bronchus, has through common usage come to designate that portion supplied by a tertiary bronchus. The importance of these pulmonary segments in pathogenesis, diagnosis, and treatment of many lung diseases is now widely recognized.

To the specialist in pulmonary diseases, the distribution of certain segments and the direction of their draining bronchi explain the effects of gravity on the localization of lung abscess (4) and suggest more effective methods of postural drainage for lungs and bronchi (12). To the thoracic surgeon, segmental resection for bronchiectasis (7), tuberculosis (5, 6), and other diseases, presents an opportunity for conservation of pulmonary tissue and pulmonary function. The bronchopulmonary segments are consequently of interest to all clinicians having occasion to study chest roentgenograms.

Attention has been called to the radiographic appearance of segmental pulmonary disease (16) and to the influence of retrocardiac processes on the contour of the cardiac silhouette (9, 15). The extent, however, to which segmental localization of pulmonary disease can be recognized from the conventional postero-anterior chest roentgenogram, is not fully appreciated.

By applying the principles of x-ray projection to the three-dimensional anatomy of the bronchopulmonary segments, the writer has found it possible, in most instances, to determine from the routine chest film the anterior or posterior location of lung processes, as well as the segment involved. The following schematic presentation is offered as a guide to segmental localization on the postero-anterior chest roentgenogram. It is not intended to exclude the use of oblique or lateral films, or to minimize either the importance of lateral chest planigraphy for accurate preoperative localization of tuberculosis or the need for bronchography in mapping out the extent of surgery for bronchiectasis.

LOBES

For orientation, it may be well to review the five lobes into which the two lungs divide, as well as the commonly recognized accessory lobes. Although the lobe formations are not always separated by fully developed fissures, the appearance of their total involvement as seen on the postero-anterior chest film must be distinguished from that of their component segments. The distribution of the three lobes of the right lung and the two lobes of the left lung, as well as the extent to which they overlap the contours of heart, diaphragm, and adjacent lobes, is shown in the three-dimensional drawing in Figure 1. The reason for past references to the upper and right middle lobes as the anterior lobes (striped), and the lower lobes (shaded) as the posterior lobes, can be appreciated from this drawing. For purposes of simplification, the postero-anterior projections of the individual lobes are presented in Figure 2. The usual difference in height between the apices of the right lower lobe and left lower lobe can be noted from the drawings in Figures 1 and 2.

[1] From the Chest Service, Lincoln Hospital, and the Department of Diagnostic Roentgenology, Montefiore Hospital, New York, N. Y. Accepted for publication in February 1952.

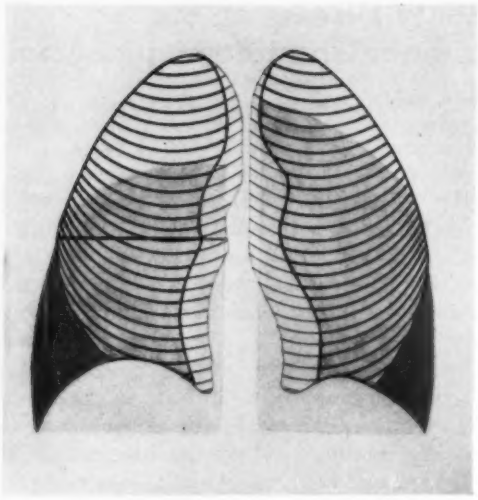

Fig. 1. A three-dimensional drawing of the five lobes of the lung. The posteriorly located right and left lower lobes are shaded. The upper and middle lobes of the right lung and the upper lobe of the left lung are only contoured, for a transparent effect. The relationship of the lobes to each other is thus seen from in front, in a manner similar to that presented when viewing the conventional postero-anterior chest roentgenogram. Lighter shading and contour lines indicate the overlap of heart and diaphragm.

Accessory Lobes: The writer has had the rare opportunity of examining one pair of human lungs having eleven distinct lobes with fully developed pleural fissures. Here, however, only those accessory lobes commonly seen will be described.

Drawing 6 in Figure 2 illustrates the accessory lobes which are encountered in the right lung. Only two of these, namely *b* and *c*, occur in the left lung. The azygos lobe, which varies considerably in size, is designated as *a*. It is the result of an aberrant developmental course of the azygos vein which, through infolding of parietal and visceral pleura, produces the azygos fissure (2). The azygos lobe contains a variable portion of the apical segment of the right upper lobe and occurs only on the right side, being seen in about 1 per cent of chest roentgenograms. Recognition of this anomalous lobe depends on visibility of its fissure, which usually has a lateral convexity, and on visibility of the frequently displaced and elevated azygos vein to which it owes its formation.

The accessory lobe designated as *b* (Figure 2, drawing 6), represents a subdivision of the lower lobe by an accessory horizontal fissure and was first described in 1900 by Dévé (3). This occurs more frequently in the right lung than in the left and may appear on a level with, but posterior to, the more familiar horizontal fissure which separates the right upper lobe from the right middle lobe. The posterior horizontal fissure of Dévé occurs, as a fully developed pleural fold, in about 5 per cent of lungs and as a partially developed fissure in about 22 per cent (3). This accessory lobe includes the apical (superior) segment of the lower lobe. (Compare with drawing 7 of Figure 4.)

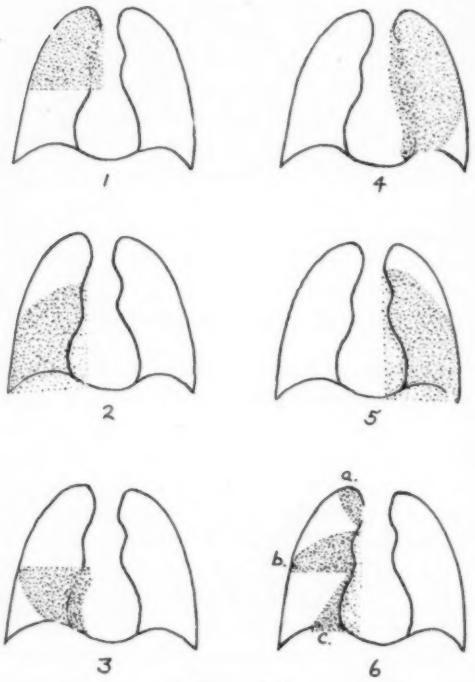

Figure 2.
1. Right upper lobe (RUL)
2. Right lower lobe (RLL)
3. Right middle lobe (RML)
4. Left upper lobe (LUL)
5. Left lower lobe (LLL)
6. Accessory lobes
   a. Azygos lobe
   b. Dévé's lobe
   c. Inferior accessory lobe

The inferior accessory lobe designated

as *c* (Figure 2, drawing 6), is referred to as such because of its location. The area which it includes corresponds to that of the median basal segment of the right lower lobe. Its involvement, therefore, produces a shadow resembling that of the latter. (Compare with drawing 9 of Figure 4.) The fissure which forms the lateral border of this accessory lobe can be seen to a variable extent in 10 per cent (Rigler) of postero-anterior chest roentgenograms.

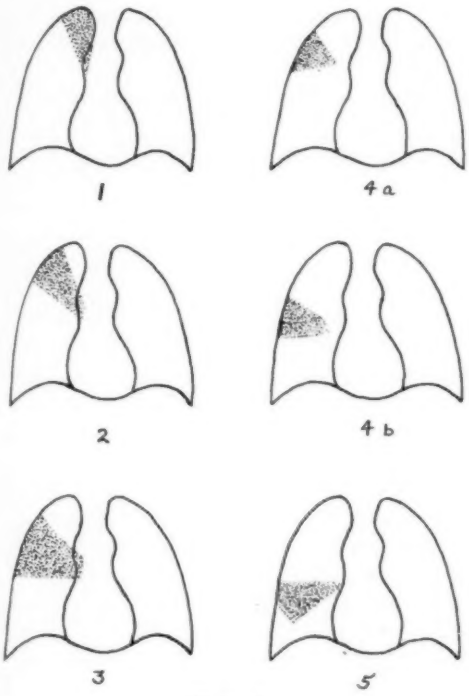

Figure 3.

1. Apical segment, RUL
2. Posterior segment, RUL
3. Anterior segment, RUL
4a. Axillary portion of posterior segment, RUL
4b. Axillary portion of anterior segment, RUL
5. Lateral segment, RML

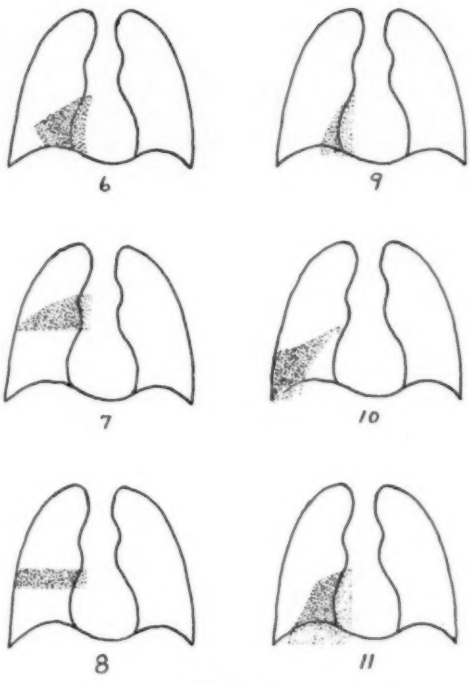

Figure 4.

6. Median segment, RML
7. Apical (superior) segment, RLL
8. Subapical segment, RLL
9. Median basal segment, RLL
10. Anterior and lateral basal segments, RLL
11. Posterior basal segment, RLL

BRONCHOPULMONARY SEGMENTS

The bronchopulmonary segments of the right lung as projected on the postero-anterior chest roentgenogram are outlined in Figures 3 and 4. For the left lung (Figure 5) only those segments are shown which differ significantly from the corresponding ones on the right.

Several different names have been given to each of the bronchopulmonary segments since Aeby and later Ewart (8) described the sublobar bronchi over half a century ago. The terminology suggested by Jackson and Huber (11) is becoming widely accepted and has helped eliminate a serious source of confusion. The only objection which might be offered to their nomenclature is with regard to the term "superior" segment of the lower lobe. This makes for clumsy reference to the frequently demonstrable subapical segment of the lower lobe, which must then be designated "subsuperior segment."

There are ten rather constant bronchopulmonary segments in the right lung. The left lung, because of a common stem origin for apical and posterior segments of the

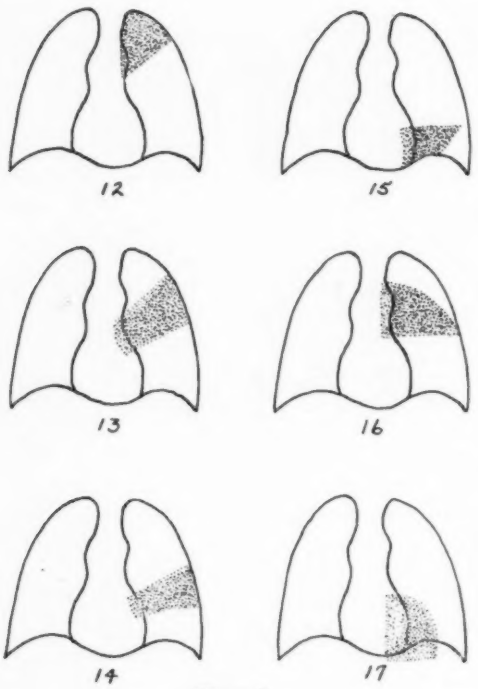

Figure 5.

12. Apical-posterior segment, LUL
13. Anterior segment, LUL
14. Superior segment, (lingula) LUL
15. Inferior segment, (lingula) LUL
16. Apical (superior) segment, LLL
17. Posterior basal segment, LLL

upper lobe, and absence of a distinct median basal segment in the lower lobe, has only eight constant segments. In 50 per cent of cases (4, 10, 14) a distinct subapical segment is present in the lower lobe, raising the possible number in the right lung to eleven and in the left lung to nine. Table I, which enumerates the bronchopulmonary segments, therefore indicates that the combined total for both lungs varies from eighteen to twenty. If the infrequent presence of a distinct and separate axillary segment (13) is reckoned in the upper lobes, the number of possible segments in both lungs increases to twenty-two.

The bronchopulmonary segments, although rather constant in occurrence, are quite variable in size and in the degree to which they overlap (4). This relation between segments is also affected by intrinsic as well as surrounding emphysema, atelectasis, or fibrosis, by collections of pleural or pericardial fluid, and by changes in position of the diaphragm. The accompanying drawings represent not the surface anatomy, but the volumetric and radiographic density distribution of the bronchopulmonary segments when involved with disease and shown on x-ray film by posteroanterior projection.

TABLE I: THE BRONCHOPULMONARY SEGMENTS

Right Lung	Left Lung
Upper lobe	Upper lobe
Apical segment	Apical-posterior segment } Upper division
Posterior segment	
Anterior segment	Anterior segment }
Middle lobe	Superior segment } Lingular division
Lateral segment	Inferior segment }
Medial segment	
Lower lobe	Lower lobe
Apical or superior segment (Subapical, 50 per cent of cases)	Apical or superior segment (Subapical, 50 per cent of cases)
Median basal segment	Anterior basal segment
Anterior basal segment	Lateral basal segment
Lateral basal segment	Posterior basal segment
Posterior basal segment	

The special nature and purpose of these schematic drawings necessarily give an incomplete impression of the overlap between segments. For further information on surface anatomy, vascular intercommunications, and other details concerning these lung units, the reader is referred elsewhere (3, 4, 11, etc.).

Right Upper Lobe: The apical segment of the right upper lobe is seen in drawing 1 of Figure 3. It overlaps somewhat the posterior segment outlined in drawing 2. The anterior segment of the right upper lobe (drawing 3) overlaps the posterior segment and the tail-like root of the apical segment. Attention is called above to the variations in size and overlap of segments. The position of the posterior segment of the right upper lobe depends not only on its relative size, but also on the height of the lower lobe upon which it rests. Disease in the apical segment of the right upper lobe always produces a shadow in the median portion of the lung apex. Isolated involvement of the posterior segment leaves this medial portion of the upper lobe

clear but results in a shadow in the outer retroclavicular and infraclavicular area.

The anterior segment (drawing 3, Figure 3) is usually the largest in the upper lobe. It reaches the horizontal pleural fissure between the right upper and middle lobes. When this bordering fissure is well developed, the lower edge of the anterior segment will be sharply defined. With disease confined to the anterior segment, the retroclavicular and median apical regions remain clear. The postero-anterior projection of this segment may be more or less characteristic, depending on whether its axillary or medial portions are involved. If its lateral (axillary) portion is affected, a triangular shadow is seen in the outer lung field above the level of the horizontal fissure (drawing 4b, Figure 3.) If its medial portion is diseased, its projection may resemble that of the apical (superior) segment of the lower lobe (see drawing 7, Figure 4). Its effect on the "central shadow" (9, 15), however, may help distinguish this medial component. The ascending portion of the aorta, which in older people curves forward and toward the right, is likely to become indistinct when the medial portion of the anterior segment is involved.

Drawings 4a and 4b in Figure 3 represent axillary subdivisions of the posterior and anterior segments of the right upper lobe. These two areas combine to form the separate axillary segment, originally described by Kramer and Glass (13), but rarely considered a distinct segment by subsequent investigators (4).

Right Middle Lobe: Drawing 5, Figure 3, outlines the lateral segment of the right middle lobe. Its upper border is formed by the horizontal pleural fissure when such exists between the right upper and middle lobes. Drawing 6, Figure 4, shows the projection of the medial segment of the right middle lobe. The lateral segment of the right middle lobe suggests an inverted pyramid in the outer portion of the lung, with its base at the level of the horizontal fissure. The median segment, which also presents a triangular shadow, has its base along the lower cardiac contour and adjoins the anteromedial portion of the right diaphragm. These two segments of the middle lobe are easily distinguished, by their shape and distribution on the postero-anterior chest roentgenogram, from those of the underlying lower lobe. The identity of the medial segment of the right middle lobe may be verified further by its indistinguishable fusion with the cardiac silhouette. When a shadow in this region fails to obliterate the adjacent segment of the cardiac countour, it generally represents disease in the median and/or posterior basal segments of the right lower lobe.

Right Lower Lobe: The area of projection for the apical (superior) segment of the right lower lobe is outlined in drawing 7, Figure 4. It extends up behind the anterior segment of the right upper lobe. (Compare with drawing 3, Figure 3.) Comparison of these segments which overlap, on the postero-anterior chest roentgenogram, discloses a characteristic difference in shape and distribution which permits their ready identification. The apical segment of the right lower lobe also extends medially behind the upper half of the lung root shadow and that portion of the cardiac silhouette which represents the ascending aorta and the superior vena cava. Minimal disease in this area, or even tuberculous cavity formation, may therefore be easily overlooked or confused with lung root shadows. The ability to distinguish clearly the convex ascending portion of the aortic arch from an adjoining shadow constitutes evidence of disease in the apical segment of the lower lobe (9, 15).

The appearance of the subapical segment of the right lower lobe on the postero-anterior chest roentgenogram is seen in drawing 8, Figure 4. This area is supplied, in about 50 per cent of cases (4, 10, 14), by one or more well developed tertiary bronchi arising in monochotomous fashion from the posterior wall of the lower lobe bronchus. When not present as a distinct sublobar segment with its own tertiary

bronchus, this area is included in the posterior basal segment of the right lower lobe. Disease in the subapical segment can generally be distinguished from that in the apical (superior) segment by its lower position with reference to the lung root shadows and cardiac contour. With total involvement of the subapical segment by disease, its shape is "pancake," since it extends back horizontally between apical and posterior basal segments of the lower lobe. The subapical segment of the lower lobe may also be distinguished from the overlying segments of the middle lobe by the difference in shape and distribution of its density, and by its failure to influence visibility of the cardiac contour. (Compare with drawing 5, Figure 3 and drawing 6, Figure 4.)

The median basal segment, which occupies the retrocardiac area of the right lower lobe, is seen in drawing 9 of Figure 4. Little trouble should be encountered in distinguishing it, by its distribution and shape, from the overlying median segment of the right middle lobe. (Compare with drawing 6, Figure 4.) Some similarities, however, may occur in the postero-anterior projection of the median basal segment and the underlying posterior basal segment of the right lower lobe (drawing 11, Figure 4). The fact that the lateral contour of the posterior basal segment has a high convexity and that its larger size is further exaggerated in the anteroposterior projection, generally makes its identification simple. Especially under the influence of fibrosis or atelectasis the posterior basal segment may, in this view, be indistinguishable from the median basal segment. Under the latter circumstances differentiation between these two may require the aid of a lateral or oblique film. The relatively greater influence of the median basal segment on the visibility of the adjacent cardiac contour may help identify it from the posterior basal segment.

Drawing 10 of Figure 4 represents the combined distribution of the anterior basal segment and the lateral basal segment of the right lower lobe. These two are not readily distinguishable from each other on the postero-anterior chest roentgenogram and are therefore not illustrated separately. When the shadow has a completely lateral distribution, limited less clearly by the lower convexity of the oblique fissure, it is more likely to represent the lateral basal segment. When the shadow involves mainly the lowermost portion of the outer lung field without completely obliterating illumination of the lateral costophrenic sulcus, it is likely to represent the anterior basal segment of the right lower lobe. Here a degree of judgment based on experience becomes helpful, but recourse to a left anterior oblique roentgenogram may prove necessary. The narrow root portions of the anterior and lateral basal segments may not be clearly seen, since their total density, even in the presence of disease, is much less in volume than that of the overlying and underlying aerated lung tissue.

The appearance of the posterior basal segment of the lower lobe (drawing 9, Figure 4), and the difference in its contour and size as compared with the median basal segment of the same lobe, have been considered above.

In the order of frequency, lung abscess tends to involve the axillary subdivisions of the posterior segment and the anterior segment of the right upper lobe, and the apical (superior), subapical, and posterior basal segments of the right lower lobe (3, 4). Corresponding segments in the left lung are less frequently involved, depending on posture habits and other gravitational influences and bronchial emboli.

Left Upper Lobe: Figure 5 presents only those segments of the left lung which differ significantly in size, shape, or position from the corresponding segments in the right lung. Drawing 12, Figure 5, shows the apical-posterior segment, which corresponds to the apical and posterior segments in the right upper lobe. These component subsegments may become involved individually, as occurs on the right. Arising in the left upper lobe from

a common tertiary stem bronchus, they constitute by definition a single sublobar "bronchopulmonary segment." Although of variable size, the combined apical-posterior segment is generally somewhat smaller than the anterior segment of the left upper lobe. Its component, when individually involved, can be distinguished in the manner described for the right side.

Drawing 13 of Figure 5 outlines the anterior segment of the left upper lobe. The projected outline of this segment differs from that of the right upper lobe only in that its lower border extends obliquely upward as well as outward. (Compare with drawing 3, Figure 3.) This characteristic distribution on the postero-anterior chest roentgenogram distinguishes it from the underlying apical (superior) segment of the left lower lobe. (Compare with drawing 16, Figure 5.) The anterior segment of the left upper lobe extends over a broader area of the upper and outer lung field than the more medially confined and posteriorly located apical segment of the lower lobe. At times, the anterior segment can be further distinguished by its local influence on visibility of the cardiovascular silhouette. It is occasionally separated from the lingular division of the left upper lobe by a more or less completely formed pleural fissure.

The outline of the superior segment (lingular division) of the left upper lobe, is seen in drawing 14, Figure 5. This corresponds to the lateral segment of the right middle lobe, from which it differs by extending obliquely upward. Its broad lateral distribution distinguishes the superior segment of the lingula from the subapical segment of the left lower lobe (see corresponding outline in the right lung, drawing 8, Figure 4).

The projection of the inferior segment (lingular division) of the left upper lobe is shown in drawing 15, Figure 5. Its shadow fuses indistinguishably with that of the cardiac silhouette, as is true of the medial segment of the right middle lobe.

Left Lower Lobe: Drawing 16, Figure 4, is included only to emphasize the higher level of the apical (superior) segment of the left lower lobe as compared with that on the right. (Compare with drawing 7, Figure 4.) Its identity can be easily established in the manner noted for the corresponding segment of the right lower lobe.

In the left lower lobe the area corresponding to the median basal segment on the right is part of the anterior basal segment. This probably represents anatomical adaptation of the left lung to the encroachment of the heart.

The visibility of the posterior basal segment of the left lower lobe on the routine chest roentgenogram (drawing 17, Figure 5), will, apart from any influence like atelectasis, vary with the depth of inspiration, height of the diaphragm, the size of the heart, and the type of habitus. Aside from greater overlap by the heart shadow, its postero-anterior projection will resemble that described for the right lung, as will the criteria for its identification.

The drawings of Figure 6 are included as exercises in segmental localization of pulmonary disease. They represent actual cases encountered in this writer's experience and include disease processes which often fail to involve the entire segment. Although many of these lesions demonstrate incomplete involvement of their respective pulmonary segments as outlined in Figures 3, 4, and 5, it is generally possible to localize them accurately on the basis of their relative position on the postero-anterior roentgenogram. Segmental localization based solely on the position of a lesion is not difficult if one only bears in mind the radiographic density distribution of the pulmonary segments and the direction of their tertiary bronchi. It is the direction of these segmental bronchi which, along with gravitational factors, serves to determine the intrasegmental location of all lesions that are bronchogenic in origin.

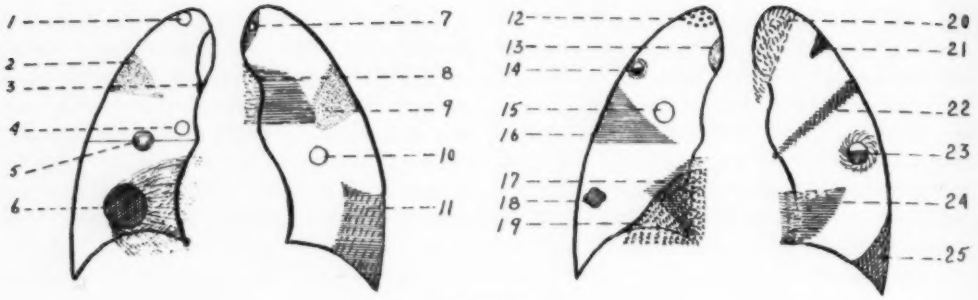

Figure 6

1. Cavity, apical segment, RUL
2. Infiltration, posterior segment, RUL
3. Aberrent azygos vein and azygos fissure
4. Cavity, apical (superior) segment, RLL
5. Tuberculoma, subapical segment, RLL (projected across line of fissure between right upper lobe and right middle lobe)
6. Chronic lung abscess, posterior basal segment, RLL
7. Cavity and infiltrations, apical portion of apical-posterior segment, LLL
8. Contracted and consolidated apical (superior) segment, LLL
9. Infiltrations, anterior segment, LUL
10. Cavity, subapical segment, LLL
11. Consolidation lateral basal segment, LLL
12. Infiltrations, apical segment, RUL
13. Infiltration, apical segment, RUL
14. Abscess, posterior segment, RUL
15. Cavity, apical (superior) segment, RLL
16. Pneumonia, anterior segment, RUL
17. Consolidation, medial segment, RML
18. Neoplasm, lateral basal segment, RLL
19. Infiltrations, medial basal segment, RLL
20. Infiltrations, apical portion of apical-posterior segment, LUL
21. Infiltration, posterior portion of apical-posterior segment, LUL
22. Atelectasis, anterior segment, LUL
23. Abscess, superior segment (lingula) LUL
24. Consolidation, inferior segment, (lingula) LUL
25. Pleural fluid, left costophrenic recess.

DISCUSSION

The bronchopulmonary segments are particularly significant in the pathogenesis of diseases due to aspiration, such as lung abscess, in the bronchogenic spread of tuberculosis, and in the intrabronchial effects of primary lung carcinoma. These sublobar segments constitute important anatomical facets in the analytical and deductive interpretation of chest x-ray shadows. A thorough knowledge of their potential alteration in distribution, size, and shape, under the intrinsic and extrinsic influence of emphysema, fibrosis, atelectasis, and infiltration is often helpful in dissociating pulmonary from pleural or mediastinal disease. The addition of such knowledge to the basic anatomic and radiographic concepts of the bronchopulmonary segment increases the observer's ability to identify such lung units on the postero-anterior chest roentgenogram even in more complicated cases. With practice, it also becomes possible in many instances, to identify combinations of segments that are overlying or contiguous to each other.

The therapeutic importance of identifying these bronchopulmonary segments has been referred to in the introductory remarks. It may be added that segmental localization of pulmonary disease can guide the endoscopist toward the tertiary bronchus, in which he must probe for a foreign body. It also helps to determine the correct approach for surgical drainage of an acute lung abscess or removal of a chronic abscess and makes possible more effective preoperative or medical application of such procedures as postural drainage.

SUMMARY

The possibilities of segmental analysis

and localization of pulmonary disease from the routine postero-anterior chest roentgenogram are discussed. A set of schematic drawings is presented as an aid to such x-ray interpretation. These are based not on surface anatomy but on the radiographic density distribution of the bronchopulmonary segments. This method of localization, while simple and reliable, is not intended as a substitute for lateral and oblique films or for procedures such as bronchography and lateral planigraphy, which are so necessary to the accurate preoperative planning of segmental surgery.

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SUMARIO

Localización Segmentaria de las Afecciones Pulmonares en las Radiografías Postero-Anteriores del Tórax

El término de "segmento broncopulmonar," aunque tiene aplicación a cualquier zona de tejido pulmonar servida por un bronquio, ha venido, por virtud del uso, a designar más bien la porción servida por un bronquio terciario. Ya está ampliamente reconocida la importancia que poseen dichos segmentos en la patogenia, el diagnóstico y el tratamiento de muchas neumopatías.

Aplicando los principios de la proyección roentgenológica a la anatomía tridimensional de los segmentos broncopulmonares, al A. le ha resultado posible, en la mayor parte de los casos, determinar por la radiografía torácica corriente la localización anterior o posterior de los procesos pulmonares, así como el segmento afectado.

Como ayuda a esa presentación radiológica, ofrécese una serie de dibujos esquemáticos, basados no en la anatomía superficial sino en la distribución del espesor radiográfico en los segmentos broncopulmonares. Este método de localización, aunque sencillo y fidedigno, no se propone como substituto de las radiografías laterales y oblicuas o de la broncografía o planigrafía lateral, tan necesarias para el exacto planeamiento preoperatorio de la cirugía segmental.

Roentgen Doses During Diagnostic Procedures[1]

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THE EVER-INCREASING exposure of man to ionizing radiations in medicine, industry, and warfare presents the problem of determining, with practical accuracy, the doses to which an individual may be subjected. Skin, depth, and volume doses used in therapy can be determined from tables on these subjects formulated by Quimby (11), Mayneord (21), and others. Formulae for dosages delivered by radioactive isotopes also have been described in the literature (25, 26). This report is devoted to describing a method by which skin, depth, and integral doses resulting from diagnostic radiologic procedures can be estimated.

Leonard (1), in 1898, was the first to describe an "x-ray burn" in the American literature. Leddy and his associates (2–5) published a series of articles in 1935 and 1937 warning of the dangers associated with fluoroscopy. Braestrup (6), in 1942, calculated the average radiation doses that a patient would receive during several types of diagnostic radiologic examination. Smedal (7), also in 1942, published tables of roentgen outputs with several different filters, target-film distances, kilovoltages, and milliampere-seconds used in some of the diagnostic procedures. Martin (8), in 1947, showed by means of graphs the effects of various filters and focal-skin distances on the radiation dose received per second per milliampere at 70 kv.p. for several common diagnostic examinations.

The above-mentioned reports and the experimental data recorded in the next section of this study demonstrate large variations in dose rates from different types of roentgenographic and fluoroscopic machines under supposedly identical conditions. The graphic and tabular information presented in this paper was formulated primarily for use in the Department of Radiology of the Hospital of the University of Pennsylvania, in which the measurements were made, and it should not be assumed that they are applicable elsewhere. However, it is believed that anyone wishing to use these values can do so by making ionization chamber readings on his own machine, using 1 mm. Al added filter, 26.4 inches target-chamber distance, and any convenient milliampere-seconds and kilovoltage, and comparing his result with the values given herein. If such values check fairly closely with those shown in Figure 3, these curves can be used for that machine. If there is a great difference, the ratio of the measured value to the value from Figure 3 will be a correction factor which will enable practical estimates to be made.

EXPERIMENTAL DATA

The basic data described herein are air-dose rates measured at focal spot-chamber distances of from 30 to 100 cm. in the central beams of x-rays produced by 12 four-valve rectified, 1 mechanically rectified, and 1 self-rectified roentgenographic and fluoroscopic units. Measurements of air-dose rates were made by means of a Victoreen condenser r-meter.

The apparatus tested was installed in the Philadelphia General Hospital (2 machines), the Temple University Hospital (2 machines), and the Hospital of the University of Pennsylvania (10 machines). These tested machines were manufactured by various companies (Standard 3, Picker 2, Keleket 2, General Electric 2, and Westinghouse 5).

The original data were recorded for values of several technical factors within

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

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the following ranges: focal spot-chamber distance, 30 to 100 cm.; added filter, 0 mm. Al to 3.5 mm. Al; x-ray tube voltage, 40 kv.p. to 90 kv.p.; exposure times, 1/60 second to 10 seconds; x-ray tube current, 3 ma. to 480 ma. It is not practical to present all of this information, nor is it necessary to do so in order to establish a method for determining approximate skin, depth, and integral doses resulting from roentgen diagnostic procedures. Such a method is achieved, as described below, by indicating the doses for a few of the most commonly used values of technical factors: focal spot-skin distances of 40 cm. (15.75 inches) for fluoroscopy and 67 cm. (26.4 inches) for radiography; 1 mm. Al added filter; x-ray tube voltages of 40, 50, 60, 70, 80, 90 and 100 kv.p.; and an exposure of 100 ma.-seconds. Auxiliary curves provide information for estimating the doses with other filters, focal spot-skin distances, and milliampere-second exposures.

As noted above, the original data comprised measurements of air-dose rates. Skin and depth doses (Figs. 4 and 5) were computed by combining the air-dose rates from Figure 3, the data on half-value layers as given on page 241, and the published data of Quimby *et al.* (11) on percentage back-scatter and percentage depth dose. Beyond a depth of 10 cm. the curves were extrapolated. The integral doses were computed by the formula presented by Mayneord (18). It is shown that the integral dose varies somewhat, depending on whether the trunk, head, or extremities are irradiated. Mayneord and Clarkson (22), using 200 kv.p., give the ratio of head to trunk as 0.76, and extremities to trunk as 0.77. Ratios are not available for kilovoltages used in the diagnostic range (50 to 100 kv.p.). The integral doses obtained from diagnostic procedures are so low that, for the purposes of this study, no correction was made for the different parts of the body irradiated, and the values given are maximum doses.

Before presenting the experimental data, it is important to review briefly the well known fact that the outputs of diagnostic x-ray apparatus vary markedly. Variations in output, measured by the densities of films, have long been the subject of investigation (9, 10). Measurements of the air dose from roentgenographic apparatus (6) show that the x-ray outputs of such machines vary in a manner that would not be tolerated in roentgen-therapy equipment. Large variations in the air dose produced by diagnostic x-ray equipment are attributable to many factors, among which the most important are differences in voltage calibration, the absorbing and scattering properties of the materials in the tubes and the tube housings, the added filters, the line voltages, the x-ray tube cathode temperatures and subsequent differences in x-ray tube currents, and exposure times. The observed variations in film densities are attributable to these causes of variations in x-ray output and to all of the variations of films, intensifying screens, and film processing.

Stenstrom and Vigness (17) found ratios of outputs of 2.5 to 1 for unfiltered rays on x-ray generators adjusted for supposedly identical technics, and of 2 to 1 for filtered rays. They quote Nurnberger as having measured a variation of 1.8 to 1. Examination of Figure 1 of Martin's article (8) shows a deviation from the average values reported by Braestrup, Smedal, Stevenson and Leddy, Barclay and Mayneord of ± 44 per cent for unfiltered rays and ± 23 per cent for rays filtered through 1 mm. Al added filter. Martin does not state the deviations from the average in his own measurements.

Variations as great as ± 20 per cent were measured in the outputs of the roentgenographic and fluoroscopic machines tested during the project described in this paper. These variations were observed not only in different departments of radiology, but also in machines of the same design and manufacture in the same department. In fact, the output of one machine varied 46 per cent from the time the original readings were made until the check readings were made. During

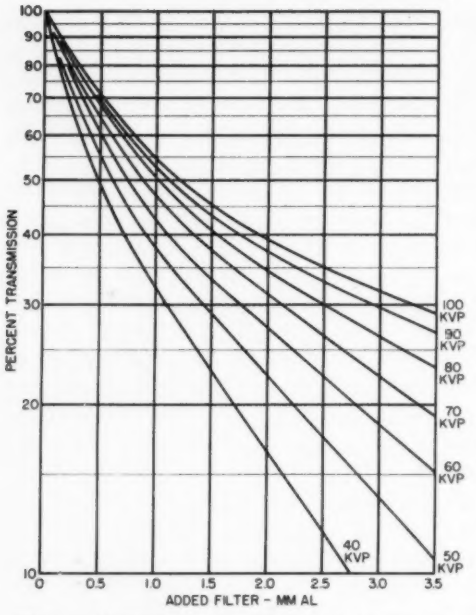

Fig. 1. Absorption curves obtained by averaging the values of per cent transmission measured on diagnostic x-ray equipment.

this interval, however, a new x-ray tube had been installed and, as stated previously, this is one of the major causes of such variations. Outputs of machines varied as much as ±10 per cent for a change of one step of the line-voltage control, and there were times when the readings were made with the line-voltage indicator either above or below the correct setting, because adjustments could not be made more accurately.

For practical purposes, we have assumed that an approximate determination of the dose to which patients are subjected during diagnostic procedures is adequate. For example, it is important to know that some part of a patient has received 5 r rather than 100 r. It is seldom of any practical significance to know that the dose is 1.16 r. instead of 2.00 r (implying that the accuracy is approximately 0.5 per cent).

As shown above, variations in measured outputs were as great as ±20 per cent of the average values. Since, for practical use, it is best to err on the safe side, *the curves presented in this report are not curves of averages of the measurements, but curves of 1.2 times the averages.* Therefore, when skin, depth, and integral doses are determined from these curves, the patient will *not* be exposed to a *greater* dose than that so determined, but, on the contrary, the exposure may be as much as 33.3 per cent *less* than the computed value.

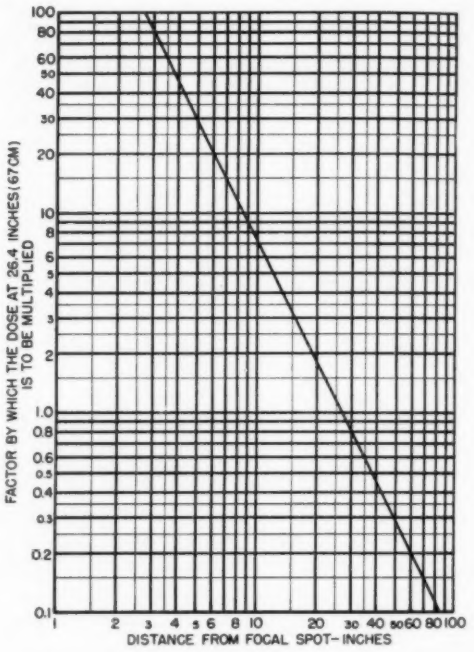

Fig. 2. Factors by which the air-dose at 26.4 inches is to be multiplied to obtain the air-dose at other distances from 3 inches up to 80 inches (inverse-square law).

Quality of X-ray Beam: The qualities of the x-ray output of the machines tested are represented by the absorption curves shown in Figure 1. Data for these absorption curves were made for filtration ranging from no added filter to 3.5 mm. Al added filter. The data for percentage transmission for each combination of x-ray tube voltage and added filter were averaged and the results were smoothed by plotting percentage transmission versus kv.p. The final results were plotted as shown in Figure 1. Data for 40 kv.p. and 100 kv.p. were obtained by extrapolation. Half-

value layers for the beams at 40 kv.p. to 100 kv.p. with 1 mm. Al added filter are as follows:

kv.p.	h.v.l. (mm. Al)
40	1.0
50	1.3
60	1.6
70	1.9
80	2.2
90	2.5
100	2.8

Variation in Dose with Different Filters: Correction factors for added filters other than 1 mm. Al can be obtained from Figure 1. For example: the factor to be used for no added filter at 80 kv.p. would be from the ratio of 100/51 or a factor of 1.96. The factor for 2 mm. Al added filter at 80 kv.p. would be 34/51 or 0.67. The correction factor for 0.5 mm. Al added filter would be 68/51 or 1.33.

Variation in Dose with Distance: For practical purposes, variation in dose for distances other than those used in plotting the graphs in Figures 3 and 4 (67 cm. or 26.4 inches) and Figure 5 (40 cm. or 15.8 inches) can be calculated by use of the inverse-square law. Figure 2 is a convenient graphic representation of the inverse-square law, where 67 cm. (26.4 inches) is given the factor of 1.0. A similar graph was not made for Figure 5, but the correction factor can be obtained by the inverse-square law.

Dosages in Air: The air doses from the machines tested, based upon the average dose measurements and multiplied by 1.2, are presented in Figure 3. These curves show the air dose obtained per 100 ma.-seconds at a distance of 67 cm. (26.4 inches) from the focal spot with 1 mm. Al added filter. As stated before, this distance was selected arbitrarily as representing approximately the most commonly used focal *spot-skin* distance in diagnostic roentgenology. If it is desired to calculate the skin, depth, and integral doses from another machine, comparison of the output of that machine with the values obtained in this graph will provide

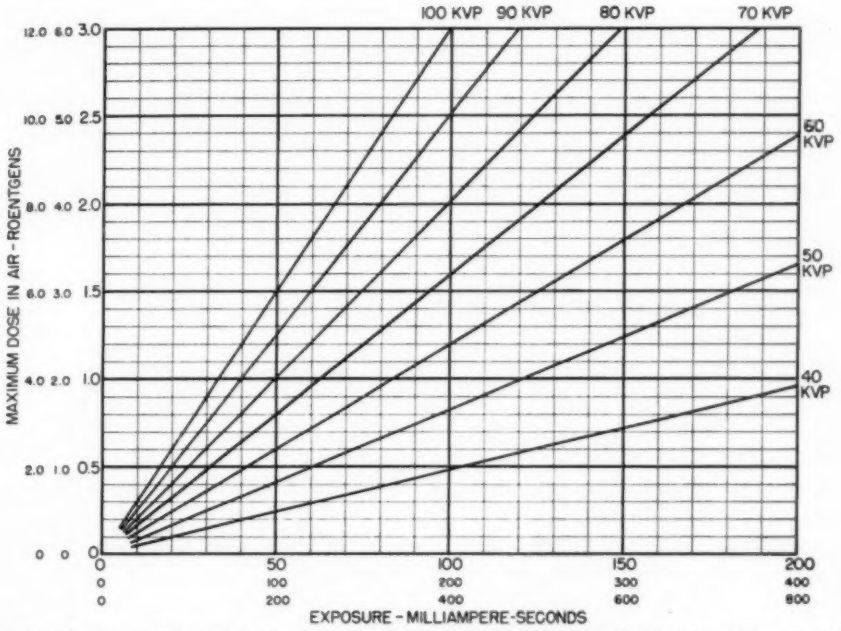

Fig. 3 Maximum air-doses obtained at a focal spot-chamber distance of 26.4 inches (67 cm.) with an added filter of 1 mm. Al.

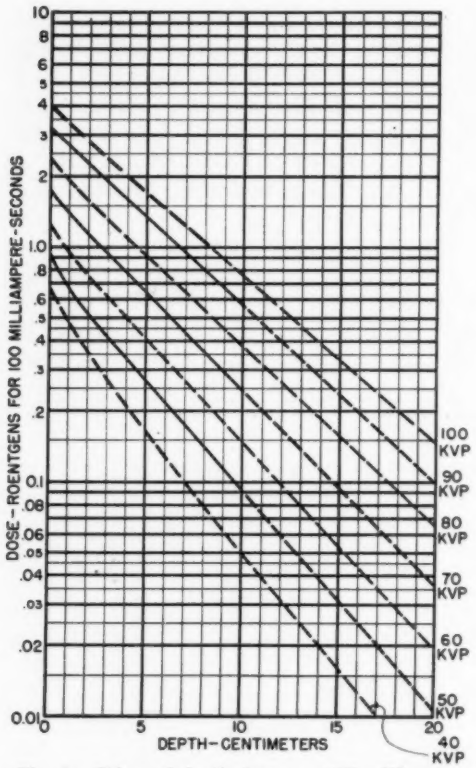

Fig. 4. Skin and depth doses per 100 milliampere-seconds at focal spot-skin distance of 26.4 inches (67 cm.) with 1 mm. of Al added filter.

the factor by which the dose obtained from Figures 4 and 5 must be multiplied. For example: Suppose the output of a machine is 1.8 r in air, using the factors of 1 mm. Al added filter, 67 cm. (26.4 inches) focal spot-chamber distance, and 80 kv.p. for 100 ma.-seconds. From Figure 3, one gets a value of 2.0 r using the same factors. It is apparent that the skin and depth doses derived from the graphs in Figures 4 and 5 must then be multiplied by 0.9.

Skin and Depth Doses: Figure 4 is a graphic representation of skin and depth doses per 100 ma.-seconds of exposure for various kilovoltages, 1 mm. Al added filter, and 67 cm. (26.4 inches) focal spot-skin distance. Figure 5 is a similar graphic representation of doses obtained at a focal spot-skin distance of 40 cm. (15.8 inches). Zero on the abscissae of these graphs represents the skin dose. The other numbers on the abscissae represent depth in centimeters below the skin. Figure 4 was computed to provide a ready means of determining dosages commonly used in roentgenographic procedures. Figure 5 was computed as a similar means for obtaining the dosages from fluoroscopic procedures.

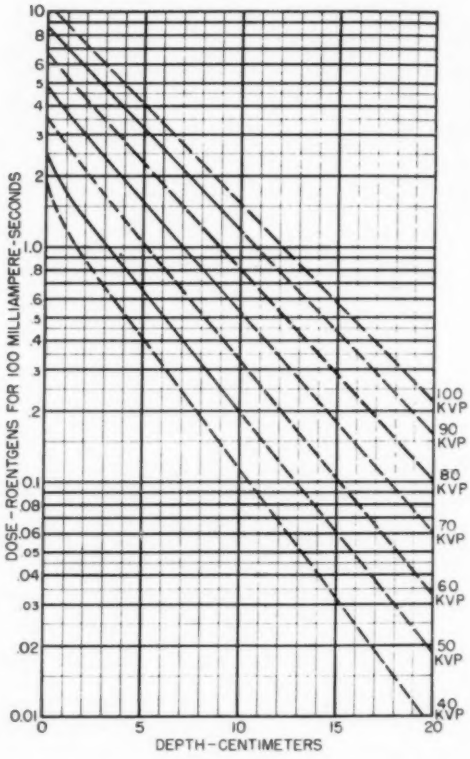

Fig. 5. Skin and depth doses per 100 milliampere-seconds at focal spot-skin distance of 15.8 inches (40 cm.) with 1 mm. of Al added filter.

Variation of Dose with Milliampere-seconds Exposure: The doses given in Figures 4 and 5 are for 100 ma.-seconds of exposure. If the dose for 50 ma.-seconds of exposure is desired, the values obtained from Figures 4 and 5 are halved. The correction factor for any milliampere-seconds of exposure other than 100 is obtained in a similar manner.

Volume and Integral Doses: Volume dose

is expressed in "c.c. roentgens" and is defined as the amount of energy absorbed when a dose of one roentgen is delivered throughout one cubic centimeter of water or of "soft tissue" (19, 20). Integral dose is expressed in "gram-roentgens" and is defined by Mayneord as the "energy conversion when a dose of one roentgen is delivered to one gram of air" (21).

Soft tissue and air are so similar in respect to energy absorption per unit mass, that the difference between these two units may be neglected for practical purposes. The "gram-roentgen" is a unit of "integral dose," representing the total absorption throughout a given mass of tissue. For clinical use the "gram-roentgen" is too small and a "megagram-roentgen" (one million gram-roentgens) is a convenient unit (22).

The integral doses given in this report are computed from the formula given by Mayneord (18):

$\Sigma = 1.44\ A.D.d_{1/2}$

Σ = Integral dose
A = Area of the field on the skin in sq. cm.
D = Dose with back-scatter on the skin.
$d_{1/2}$ = Depth in cm. at which the dose falls to half the value of the skin dose. (The values for both D and $d_{1/2}$ can be obtained from Figures 4 and 5.)

PRACTICAL APPLICATION

Suppose one wishes to estimate the dose to the skin and ovaries and the integral dose given to a patient during the taking of an anteroposterior roentgenogram of a pelvis measuring 20 cm. It is assumed that the ovaries occupy a point midway in the pelvis, or a depth of 10 cm. from the skin.

For simplicity, we will assume that the output of the equipment used is similar to that represented in Figure 3. One mm. Al added filter was used, the focal spot-film distance was 36 inches; it required 100 ma.-seconds at 70 kv.p.; the exposure was made on a 14 × 17-inch film.

Referring to Figure 4, one gets a value of 1.75 r at 0 cm. depth, or the dose on the skin, and a value of 0.25 r at 10 cm. depth, for the above factors. These doses are for a focal spot-skin distance of 26.4 inches, whereas that used in this example is 26.1 inches. From Figure 2 we find that a focal spot-skin distance of 26.1 inches requires a correction factor of 1.1. Hence, the skin dose will be 1.75 times 1.1 or 1.9 r. The depth dose at 10 cm. will be 0.25 times 1.1 or 0.28 r.

Using the formula, "integral dose Σ = $1.44\ A.D.d_{1/2}$," we get 11,200 gram-roentgens as the integral dose.

A is the area on the skin exposed in sq. cm. = 14 × 17 = 238 in.^{2} = 1,535 cm.^{2}
D is the estimated dose with back-scatter on the skin = 1.9 r
$d_{1/2}$ is the depth in cm. at which the dose on the skin is halved and is obtained from Figure 4 = 3.8 cm. using 70 kv.p.

If one desires to calculate the dose received during fluoroscopic procedures, it is more convenient to use Figure 5 and correct for focal spot-skin distances other than 40 cm. (15.8 inches) by using the inverse-square law.

COMPARISON OF DIRECT MEASUREMENTS, DATA DERIVED FROM CURVES, AND DATA FROM OTHER INVESTIGATORS

Since the curves presented in the graphs in this paper were purposely derived from maximum measurements, doses derived from them may be expected to be equal to or greater than direct measurements. A few such measurements were made after the preparation of the curves to check their usefulness; these tests are described briefly below.

Fluoroscopes: The tests described in this paragraph were made on three fluoroscopic machines as they were used in clinical practice. In the case of one of these, upon which ionization chamber readings were made with fluoroscopic settings, the milliampere reading was 6 ma. instead of 5 ma. In a second case, the focal spot-table top distance was 14 5/8 inches instead of 15.75 inches, which is the distance from which the curves of Figure 5 were prepared. The filters in the various fluoroscopic tubes differed, the maximum value of added filter being 1.5 mm. Al. All tubes

TABLE I: SPOT CHECKS OF FLUOROSCOPES
(80 kv.p.*; 5 ma.)

Fluoroscopes	Measurement in Air at Table Top (r per min.)	Calculation in Air at 15.75 in. (40 cm.) Added Filter 1.5 mm. Al From Figs. 1, 2, 3 (r per min.)	Measurement with Back-Scatter (r per min.)	Calculation with Back-Scatter at 15.75 in. (40 cm.) Added Filter 1.5 mm. Al From Figs. 1, 2, 5 (r per min.)
A (5 ma.)	9.0	13.3	11.5	17.3
B (6 ma.)	14.0	15.9 (at 6 ma.)	17.5	20.7 (at 6 ma.)
C (5 ma.)	13.6	15.9 (at 14 5/8 in.)	17.0	20.7 (at 14 5/8 in.)

* Manufacturer's calibration.

were operated at 80 kv.p. (manufacturer's calibration). The results of these spot checks are shown in Table I.

Roentgenographic Apparatus: A check of one 4-valve, 500-ma. machine at 60 ma., 1 sec., 36 in., in air gave the results listed in Table II.

TABLE II: SPOT CHECK OF FOUR-VALVE ROENTGENOGRAPHIC APPARATUS
(60 ma., 1 sec., 36 in., 1 mm. Al added)

Kv.p.	Measurement in Air (roentgens)	Calculation from Figs. 2 and 3 (roentgens)
40	0.16	0.16
50	0.26	0.28
60	0.35	0.40
70	0.46	0.53
80	0.59	0.66
90	0.70	0.83

Several check readings of depth doses were made using a "masonite presdwood" phantom. The measurements were from 5 to 25 per cent less than the values obtained from the curves. The chamber was held against the skin to obtain a reading during a lateral exposure of the lumbar spine; the measured dose was 4.5 r, and the value obtained from the curves was 4.8 r.

These check readings show that the curves of Figures 1, 2, 3, 4, and 5 can be used to calculate approximately the doses in air, surface, and depth, for diagnostic technic at the Hospital of the University of Pennsylvania. The actual doses will be, in general, equal to or less than the calculated doses by no more than 33-1/3 per cent.

Finally, check readings of air doses were made on two machines at the Philadelphia General Hospital and on two machines at the Temple University Hospital. Readings of the two x-ray generators that gave the highest output are compared in Table III, with calculated values.

TABLE III: SPOT CHECKS OF TWO FOUR-VALVE ROENTGENOGRAPHIC MACHINES
(1 mm. Al added)

Machines	Kv.p.	Ma.-Sec.	Measured Air Dose at 36 in. (roentgens)	Calculated Air Dose Figs. 2 and 3 (roentgens)
D	50	300	0.98	1.34
D	60	200	0.98	1.30
D	70	180	0.99	1.54
D	80	125	1.00	1.35
D	90	100	1.00	1.35
E	50	300	1.08	1.34
E	60	200	1.00	1.30
E	70	150	0.96	1.29
E	80	150	1.20	1.64

The measured doses are consistently lower than the calculated values in Table III. As previously stated, the average air doses obtained from the original r-meter readings were purposely increased 20 per cent when they were plotted on the curves of Figure 3, because of the great variability in output of diagnostic machines.

Comparison with Other Reported Observations: A comparison of the roentgen output of diagnostic x-ray equipment is given in Table III, page 213, of Braestrup's report (6). He chooses an average value of 4.82 r per 100 ma.-seconds in air, at 80 kv.p., 50 cm. focal-skin distance, with

0.5 mm. Al added filter. A comparable figure can be obtained from Figures 1, 2, and 3. From Figure 3, the air-dose rate at 80 kv.p., 67 cm. distance, 1 mm. Al added filter, is 2.0 r per 100 ma.-seconds. From Figure 2, the factor for multiplying the dose rate at 67 cm. to obtain the dose rate at 50 cm. is 1.8. From Figure 1, the factor for multiplying the dose with 1 mm. Al added filter to obtain the dose rate with 0.5 mm. Al added filter is 68/50.2 = 1.35. Therefore, the calculated dose rate to be compared to Braestrup's value of 4.82 r per 100 ma.-seconds is 2 × 1.8 × 1.35 = 4.86 r per 100 ma.-seconds.

In Table IV, page 213, of Braestrup's paper (6), he lists air, skin, and depth dose measurements in roentgens for a target–skin distance of 40 cm., using 80 kv.p., 100 ma.-seconds, 0.5 mm. Al added filtration. A comparison of these observations with those calculated from Figures 1, 2, 3, 4, and 5 is presented in Table IV.

TABLE IV: COMPARISON OF DOSE IN ROENTGENS BASED ON MEASUREMENTS OF BRAESTRUP (6), AND CALCULATIONS OF RITTER, WARREN AND PENDERGRASS
(Target–skin distance 40 cm. (16 in.), x-ray tube voltage 80 kv.p., added filter 0.5 mm. Al)

	Average Dose in Roentgens per 100 ma.-sec. Exposure	
	Measurements of Braestrup	Calculations from Figs. 1, 2, 3, 4, 5
r in air	7.8	7.6
r at skin	9.7	9.4
r at 3 cm. depth	4.8	5.0
r at 5 cm. depth	3.1	3.3
r at 7 cm. depth	1.9	2.2
r at 10 cm. depth	1.1	1.2

In Martin's report (8), his curves in Figure 1, page 279, for 70 kv.p., focal-skin distance 16 in., with back-scatter, show 0.05 r per second per milliampere for a *total* filtration of 1.2 mm. of Al, or 5 r per 100 ma.-seconds. From our Figures 2 and 5, the dose computed for these factors is 4.85 per 100 ma.-seconds.

Martin and Williams (12) show that, for a superior-inferior exposure in pregnancy, they require 90 to 100 kv.p., 320 ma.-seconds, 0.5 mm. Al added for a thickness of 34 cm. The corresponding skin dose they found to be 23.5 r. Our studies show a skin dose of approximately 24 r.

Martin (8) also discusses, on pages 282 and 283 of his paper on radiation doses, the maximum, minimum, and average skin doses for various diagnostic technics. In order of magnitude, these data and those presented in the next section are in agreement. In fact, in view of the great differences that must exist between apparatus and technics in the two departments of radiology, the approximate agreement in these over-all estimates is significant.

On page 15 of *Handbook 41* of the National Bureau of Standards (23), information is listed on air-dose rates from diagnostic x-ray equipment. Comparison of these data and results from Figures 2 and 3 of the present paper are listed in Table V.

TABLE V: COMPARISON OF DATA FROM HANDBOOK 41 AND FROM FIGURES 2 AND 3 OF PRESENT REPORT
(Roentgens per 100 ma.-sec. at 24 inches, 1 mm. Al added)

X-ray tube voltage (kv.p.)	50	60	70	80	90	100
Roentgens, page 15, Handbook 41 (23)	0.9	1.4	1.9	2.3	3.1	3.6
Roentgens, Figs. 2, 3 (see above)	1.02	1.5	2.0	2.5	3.1	3.7

Thus, in spite of all of the variations that prevent the accurate prediction of the doses produced during diagnostic procedure, the evidence of this investigation and the data of other workers who have studied these problems show a useful agreement. Therefore, *if a short series of measurements in another department of radiology with an r-meter show approximate agreement with the data of Figure 3, these curves may be used to determine* the approximate skin, depth, and integral doses in that clinic.

SKIN, DEPTH, AND INTEGRAL DOSES FOR DIAGNOSTIC EQUIPMENT, DEPARTMENT OF RADIOLOGY, HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

It is the purpose of this section to list the skin dose and, in some cases, the depth

TABLE VI: SKIN AND DEPTH DOSES FOR DIAGNOSTIC TECHNICS, DEPARTMENT OF RADIOLOGY, HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PENNA.

Part Examined and Projection	Average Thickness (cm.)	Ma.-Seconds	kv.p.	T.F.D.		Added Filter mm. Al	T.S.D.		Skin Dose (roentgens)	Depth Dose (roentgens)
				(in.)	(cm.)		(in.)	(cm.)		
Head										Pituitary
Lateral	16	270	60	36	91.5	1	30	76	2.8	8 cm. 0.5
AP	20	330	69	36	91.5	1	28.2	71	5.4	9 cm. 0.9
PA	20	300	62	36	91.5	1	28.2	71	4.1	11 cm. 0.5
Submento-vertex	22	420	69	36	91.5	1	27.4	69.5	7.2	11 cm. 0.8
Sinuses										
Frontal	20	270	62	36	91.5	1	28.2	71	3.4	11 cm. 0.4
Maxillary	20	315	65	36	91.5	1	28.2	71	4.3	10 cm. 0.6
Lateral	16	90	54	36	91.5	1	30	76	0.8	8 cm. 0.1
Oblique	18	270	54	36	91.5	1	29	73.5	2.5	9 cm. 0.3
Mastoids										
Bullitt	16	150	56	36	91.5	1	30	76	1.4	8 cm. 0.2
Stenvers	18	270	62	36	91.5	1	29	73.5	3.2	9 cm. 0.5
Cervical spine										
AP	12	150	54	36	91.5	1	31.3	79.5	1 2	
Lateral	12	150	64	72	183	1	67.3	171	0.4	
Dorsal spine										
AP	20	390	58	36	91.5	1	28.2	71	4.5	
Lateral	30	480	58	40	115	1	28	71	6	
Lateral	30	180	70	36	91.5	1	24.2	61	4	
Lumbar spine										
AP	20	420	58	36	91.5	1	28.2	71	4.7	
Lateral	28	450	70	36	91.5	1	25	63.5	13.5	
Oblique	24	480	64	36	91.5	1	26.6	67.5	7.3	
Lat. L-5 S-1	31	780	82	36	91.5	1	23.8	60.5	26	
Pelvis										Ovaries
AP	20	420	58	36	91.5	1	28.2	71	5.3	10 cm. 0.6
Lat. sacrum	31	750	74	36	91.5	1	23.8	60.5	21	10 cm. 2.8
Thigh and knee										
AP	18	300	55	36	91.5	1	29	73.5	2.8	
Lateral	16	240	55	36	91.5	1	30	76	2.1	
Lower leg and ankle										
AP	10	50	46	36	91.5	1	32.1	81.5	0.3	
Lateral	10	50	46	36	91.5	1	32.1	81.5	0.3	
Chest										
PA	20	24	59	72	183	1	64.2	163	0.06	
Lateral	31	24	78	72	183	1	59.8	152	0.12	
Oblique	25	24	63	72	183	1	62.2	158	0.07	
PA (Bucky)	20	36	64	50	127	1	42.2	107	0.22	
Lateral (Bucky)	31	36	77	50	127	1	37.8	96	0.43	
Stomach and duodenum										
Fluoroscopy	20	300	80	15	38.1	1.5	15	38.1	17.7 r/minute	
PA	20	75	65	36	91.5	1	28.2	71	1	
Oblique	22	75	69	36	91.5	1	27.2	68.5	1.4	
Colon										
PA	20	75	65	36	91.5	1	28.2	71	1	
Oblique	22	75	69	36	91.5	1	27.2	68.5	1.4	
Urogram										
AP	20	100	62	36	91.5	1	28.2	71	1.3	
Oblique	22	100	62	36	91.5	1	27.2	68.5	1.4	
Cystogram										Ovaries
AP	20	100	67	36	91.5	1	28.2	71	1.4	10 cm. 1.19
Oblique	22	100	66	36	91.5	1	27.2	68.5	1.4	11 cm. 1.16
Gallbladder										
PA	20	150	58	36	91.5	1	28.2	71	1.8	
Oblique	23	150	61	36	91.5	1	27	68	2	

and integral doses to the patient for each of several commonly used diagnostic technics in the Department of Radiology of the Hospital of the University of Pennsylvania in which these measurements were made. Again it is stated that these doses are maximum values. The data are presented in Tables VI and VII.

DISCUSSION

There appears to be a tentative agreement upon a "maximum permissible"

TABLE VI: SKIN AND DEPTH DOSES FOR DIAGNOSTIC TECHNICS, DEPARTMENT OF RADIOLOGY, HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PENNA.—*Cont.*

Part Examined and Projection	Average Thickness (cm.)	Ma.-Seconds	kv.p.	T.F.D.		Added Filter mm. Al	T.S.D.		Skin Dose (roentgens)	Depth Dose (roentgens)	
				(in.)	(cm.)		(in.)	(cm.)		Ovaries	Fetus
Pelvimetry											
AP	26	300	65	36	91.5	1	25.8	65	5	13 cm. 0.4	13 cm. 0.4
Lateral	34	780	78	36	91.5	1	22.6	57	26.7	11 cm. 3.5	16 cm. 1.3
Superior-Inferior inlet	34	420	75	36	91.5	1	22.6	57	14	20 cm. 0.4	15 cm. 0.9
Dental: Upper											
Molar		80	65			1.9	9		14		
Premolar		60	65			1.9	9		10		
Incisor		65	65			1.9	9		11		
Dental: Lower											
Molar		70	65			1.9	9		12		
Premolar		50	65			1.9	9		9		
Incisor		60	65			1.9	9		10		
Planigraphy											
Head											
Lateral	16	210	60	36	91.5	1	30	76	2.3		
PA	20	210	65	36	91.5	1	28.2	71	2.7		
AP	20	210	65	36	91.5	1	28.2	71	2.7		
Dorsal spine											
AP	20	210	64	36	91.5	1	28.2	71	2.7		
Lateral	29	105	65	36	91.5	1	24.6	61	1.8		
Lumbar spine											
AP	20	210	64	36	91.5	1	28.2	71	2.7		
Lateral	32	210	73	36	91.5	1	23.4	59.5	5.5		
Abdomen											
AP	20	210	58	36	91.5	1	28.2	71	2.4		

whole-body exposure to x-rays and/or gamma rays of 0.3 r per week. The National Bureau of Standards *Handbook 41* (23) states that the maximum total dose to which any part of the body of a radiation worker shall be permitted to be exposed, continuously or intermittently, in a given time, shall be 0.3 r per week. On the basis of forty-eight hours per week of uniform exposure, the permissible doses are 6.25 mr per hour; 0.104 mr per minute; 0.00174 mr per second. This determination followed two periods, each of several years duration, during which first the maximum permissible dose of 0.25 r per day (1.5 r per week) was generally accepted, and later a value of 0.1 r per day (0.6 r per week) was used. Judging from the literature on the subject, this progressive acceptance of lower permissible doses is derived from the lack of precise information on two important points: (1) the somatic (or pathologic) effects of long sustained exposures at low dose rates and (2) the genetic effects of radiation absorption on man. In the presence of these unknown factors and such related observations as the apparently high incidence of leukemia among radiologists, the tendency is to insist upon better radiation protection by specifying lower values from the maximum permissible dose. It is significant, however, that rarely is the whole body irradiated during diagnostic procedures. There has accompanied this development an implied agreement that partial-body irradiation may safely exceed the whole body dose, but very little as yet can be specified quantitatively concerning the safety of partial-body exposure relative to whole-body irradiation. Perhaps volume or integral dose determinations will be of value.

In diagnostic radiology, the problem is principally one of determining beforehand whether any contemplated examination by x-rays is likely to produce x-ray dermatitis, epilation, blood changes, glandular changes, fetal injury and/or abortion, and genetic changes as a result of *partial-body, single* or *repeated* exposures. It is not the purpose of this paper to discuss the tolerance doses, but to provide a workable means of determining doses received from diagnostic pro-

cedures. If untoward reactions are noted after x-ray examination, the various skin, depth, and volume doses can be calculated and recorded. The recordings of such reactions and dosages will provide a guide for future policy.

CONCLUSION

1. This study is a plan for more accurate knowledge of dosage received by individuals from diagnostic x-ray procedures, specifically at the Hospital of the University of Pennsylvania.

2. By use of the suggested check ionization readings, these values can be used in other departments of radiology.

3. Ionization chamber readings show that there is a great variation in the roentgen output of diagnostic equipment, using the factors at present specified by manufacturers' calibrations of kilovoltage, filtration, distance, and ma.-seconds.

4. The x-ray dosages received in diagnostic procedures are small and probably insignificant, except in cases of unusual sensitivity, in frequently repeated and serial examinations, or when such dosages are superimposed upon dosages received in roentgen therapy.

5. The x-ray diagnostic procedures that may produce over-dosage are: fluoroscopy, dental radiography, roentgenograms of the lateral lumbar spine, and pelvimetry.

6. By providing a means of determining skin, depth, and volume doses from diagnostic x-ray procedures, it is hoped that over-dosages may be prevented, badly needed x-ray examinations may not be denied because of uncertainty of dosage, and data may be accumulated which will establish standards of tolerance to ionizing radiations for the human body.

TABLE VII: AVERAGE DEPTH AND INTEGRAL DOSES FOR DIAGNOSTIC TECHNICS, HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

Routine Examination	Roentgens to Organ	Volume Dose in Gram-Roentgens
Skull		
3 Lat., 1 AP, 2 PA, 1 Hirtz	4 r, center of head	17,000
Encephalogram		
8 Lat., 2 AP, 4 PA	8 r, center of head	28,000
Chest		
2 PA, 1 Lat., 1 Bucky PA	0.1 r, center of chest	7,750
Stomach and Duodenum		
10 min. Fluoroscopy, 8 Spots, 5 Serials	3.0 r, center of abdomen	39,000
Barium Enema		
5 min. Fluoroscopy, 3 Spots, 3 PA	2.0 r, center of abdomen	22,000
Gallbladder		
3 PA, 1 Oblique	1.0 r, center of abdomen	8,600
Urogram		
6 AP, 2 Obliques	1.3 r, center of abdomen	24,000
Lumbar Spine		
1 AP, 1 Lat., 1 L-5 S-1, 2 Obliques	8.0 r, center of abdomen	97,300
Dorsal Spine		
AP and Lat.	1.5 r, center of chest	23,000
Thigh		
AP and Lat.	0.5 r, center of thigh	4,250
Lower Leg and Ankle		
AP and Lat.		270
Shoulder and Humerus		
AP		280
Bone Survey		
Lat. Skull	0.5 r	2,000
PA Skull	0.5 r	2,200
Lat. Cervical Spine	0.6 r	10,000
AP Dorsal Spine	0.7 r	11,700
Lat. Dorsal Spine	0.64 r	10,500
AP and Lat. Lumbar Spine and Pelvis	1.3 r	28,000
AP, 2 Femurs	0.6 r	4,860
AP, 2 Humeri	0.6 r	560
TOTAL		69,820

Tolerance Dose of 0.1 r/day = 7,000 gram-r/day
$0.1 \text{ r} \times 70 \text{ kg.} \times 10^3 = 7{,}000$ gram-r
30 megagram-r (30,000,000 gram-r) are frequently associated with systemic reaction.

ADDENDUM: Since this paper was prepared, an article by Sorrentino and Yalow has been published in RADIOLOGY (24). The air-dose rates reported by these authors are a few per cent less than the data presented in the graphs herein. Our slightly higher values are to be expected because we have plotted averages of our measurements plus 20 per cent.

Check readings made by one of the authors (V. W.R.) in Santa Rosa, Calif., showed a variation of roentgen output of 23 per cent between two General Electric machines and a Westinghouse machine, in different departments of radiology.

There is general agreement that the doses from most diagnostic procedures are very low and, with few exceptions, should not cause untoward reactions.

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SUMARIO

La Dosis de Rayos X Durante los Procedimientos de Diagnóstico

Este estudio representa un plan dedicado a obtener conocimientos más exactos acerca de la dosis de irradiación recibida por las personas en las que se ejecutan procedimientos roentgenológicos de diagnóstico, hablando específicamente, en el Hospital de la Universidad de Pensilvania. Los datos presentados comprenden algunos de los factores técnicos más empleados: distancias foco-piel de 40 cm. para la roentgenoscopia y de 67 cm. para la radiografía; 1.0 mm. de Al de filtración adicional; voltajes en el tubo de 40, 50, 60, 70, 80, 90 y 100 kv. p., y exposición de 100 miliamperios-segundos. Curvas auxiliares suministran información para calcular las dosis con otros filtros, distancias y exposiciones de miliamperios-segundos.

Utilizando las lecturas que se indican para comprobar la yonización, pueden usarse las cifras obtenidas en este estudio en otros departamentos de radiología.

Las lecturas de la cámara de yonización revelan la gran variación que existe en la producción de rayos por los aparatos de diagnóstico, cuando se basa la misma en los factores estipulados actualmente en las calibraciones de los fabricantes con res-

pecto a kilovoltaje, filtros, distancia y miliamperios-segundos.

Los dosis de rayos X recibidas en los procedimientos de diagnóstico son pequeñas y probablemente insignificantes, excepto en casos de inusitada sensibilidad, con exámenes frecuentes y seriados, y cuando se sobrepone la exposición para diagnóstico a las dosis recibidas en la roentgenoterapia. Los procedimientos de diagnóstico que pueden producir hiperdosis son: fluoroscopia, radiografía dental, roentgenografía de la porción laterolumbar del raquis y pelvimetría.

Al suministrar un medio de determinar las dosis cutánea, profunda y en volumen procedentes de los procedimientos radiológicos de diagnóstico, espérase impedir las hiperdosis, que no se rehusen exámenes roentgenológicos necesitados con urgencia por reinar incertidumbre en cuanto a la dosis, y acopiar datos destinados a establecer pautas de tolerancia a los rayos yonizantes de parte del cuerpo humano.

DISCUSSION

Ralph C. Moore, M.D. (Omaha, Nebr.): From the data presented I think we can derive the following pertinent information.

1. Significant dosages of radiation can be given to patients undergoing repeated or prolonged examinations of heavier parts; this is particularly true if roentgenography is supplemented by fluoroscopy. For example, the average gastro-intestinal series should give about 20 to 25 r to the skin with back-scatter from fluoroscopy supplemented by a few spot films, and an additional exposure of 4 or 5 r from films. This would then constitute close to ten times the accepted weekly maximum permissible dosage.

2. The amount of radiation a laboratory worker would receive is carefully regulated. It is only wise that radiologists, and more especially those physicians who use their own radiographic and fluoroscopic equipment, should become more conscious of the amount of radiation which their patients may be receiving. This would apply particularly to patients with fractures of the hip or spine, who would receive repeated examinations over a long period of time. In younger individuals, the gonads would receive a significantly large amount of radiation from the standpoint of increasing the mutation rate and I think we should make every effort to protect the gonads wherever practical.

3. I would like to emphasize that in the examination of young children and infants, one approaches total-body irradiation in many examinations.

4. In the literature more and more information is becoming available on the effects of minute quantities of radiation given over various periods of time. In the German literature there recently appeared an article on the effects of small daily dosages of radiation on mice. It was found that there was a proliferation of the reticulo-endothelial system as a very early manifestation. In the light of what the allergists brought forth at the meeting here in Chicago a short time ago, proliferation of the reticulo-endothelial system is related to the overproduction of antibodies. This is reversed by the action of cortisone. One of my internist friends recently stated that he had gained the impression that he was seeing more leukemia develop in his allergic patients than should be expected statistically. It might be then that this proliferation of the reticulo-endothelial system is a precursor to leukemia and that this may be related to the development of a higher incidence of leukemia among radiologists. It may also have something to do with the increase in incidence of leukemia in the general population. Whether this is due to greater accuracy in diagnosis or is an actual increase is hard to say.

In our own department, at the University of Nebraska, our physicist, Mr. Tuma, made a spot check.

For 80 kv. at 40 cm., 0.5 mm. Al filter, our values are less than those given in the paper by 30 to 40 per cent.

At 60 ma.-seconds, 36 inches, 1 mm. Al filter, the values were 20 to 40 per cent less than those in the paper.

At 100 ma.-seconds, 80 kv. gave 3.6 r in one second but the average over a period of 20 seconds was 5.7 r.

For the skull (7 exposures), Dr. Ritter mentioned 4 r. Our figure is only 1 r. I think that must be an error.

For the lumbar spine (3 exposures) Dr. Ritter mentioned 8 r. Our output was 5 r.

Our radiographic exposures appear to be well under those given in the paper. Our fluoroscopic radiation rate is greater by about 30 per cent at 6 ma. and the same at 4 ma.

Robert S. Stone, M.D. (San Francisco, Calif.): I think Dr. Ritter is to be congratulated on presenting this material and I am sure we all will be looking forward to seeing it in print, where we can study it in relation to our own problems.

There are a couple of things I would like to em-

phasize in connection with knowing the dosage that we are giving to our patients. One is that the tolerance dose as set up by the Protection Committee has nothing to do with exposures for diagnostic radiology. It is true that every one of us needs to bear in mind how much exposure our patients are receiving but our judgment must take into consideration the need of the examination and the value of the results to be obtained. If it is sufficiently important to the individual's life, we can give up to an erythema dose *if necessary*. On the other hand, the routine procedures done by some pediatricians particularly, and by some radiologists for pediatricians, with fluoroscopy every time a child is brought in, are only to be condemned. This practice is one of the reasons for our emphasizing the matter of tolerance.

Another point that has been mentioned which I would like to emphasize is that we must in every way possible protect the gonads both of women and men during diagnostic exposure. There is much useless exposure of the gonads in diagnostic procedures, but by a little thought, planning, and care we can probably take care of that situation without too much trouble.

EDITORIAL

Segmental Anatomy of the Lung

For the past decade physicians who are concerned with diseases of the chest have exhibited a renewed interest in the details of the segmental anatomy of the lungs. The interest of the radiologist in this field is exemplified in the article, "Segmental Localization of Pulmonary Disease on the Postero-Anterior Chest Roentgenogram" by Irving Kane appearing in this issue of RADIOLOGY.

The spectacular advances of thoracic surgery during the past two decades in large part date from the successful lobectomies, chiefly for bronchiectasis, done during the early thirties, and from Graham's successful pneumonectomy for carcinoma of the lung in 1933. In time the ability to remove large portions of the lung without undue risk became fully established. As long as the surgeon's efforts were confined to resection of a lobe or of a whole lung, the importance of segmental anatomy was not fully appreciated. But when Churchill, in 1939, successfully removed a segment of the lower lobe for bronchiectasis, a new emphasis was created. For it now appeared possible to remove, surgically, local areas of inflammation or small, non-malignant tumors, without a serious loss of functioning lung. Further development of the technic of segmental pneumonectomy by Blades, Overholt and his associates, Clagett, and many other thoracic surgeons in this country, has finally made local resection of the lung a relatively safe procedure, carrying a small risk, with few complications, and little abnormal residue.

There followed the demonstration that surgical excision of tuberculous foci in the lung was a practical, safe procedure for the permanent eradication of tuberculosis. Here is a situation in which it is frequently necessary to remove multiple areas while, at the same time, it is desirable to save as much normal lung as possible, so that the technics of segmental pneumonectomy become of the greatest importance. Finally, it has become possible for thoracic surgeons to remove very small areas of the lung without regard to their segmental distribution, merely excising the actual tissue involved. The latter technical development has permitted the removal of large numbers of nodules from the lungs, some of which have proved to be malignant, others benign, and still others of an inflammatory nature. Complete extirpation of such a nodule is the surest guarantee against any eventual harmful effects which it may produce. In this same way the removal of relatively quiescent, or even well defined, but active, tuberculous foci, when they are accessible, and when the patient is fully protected by antibiotics, seems to make more certain a complete cure of this disease.

Concomitant with the development of the procedures for the surgical removal of segments of the lung has come a development of technics for the accurate localization of such segments. At the time when bronchiectasis was largely a focus of attack in lung surgery, mapping of the lung by means of bronchography could be readily accomplished. The anatomical distribution of the disease was well delineated by the contrast substance within the bronchi. In the case of tuberculous foci, other granulomata, or tumor masses, bronchography is of little value. Dealing with such lesions it is necessary to have a thorough knowledge of the segmental anatomy of the lung, as exhibited in roentgenograms made without contrast, in order to localize exactly the disease

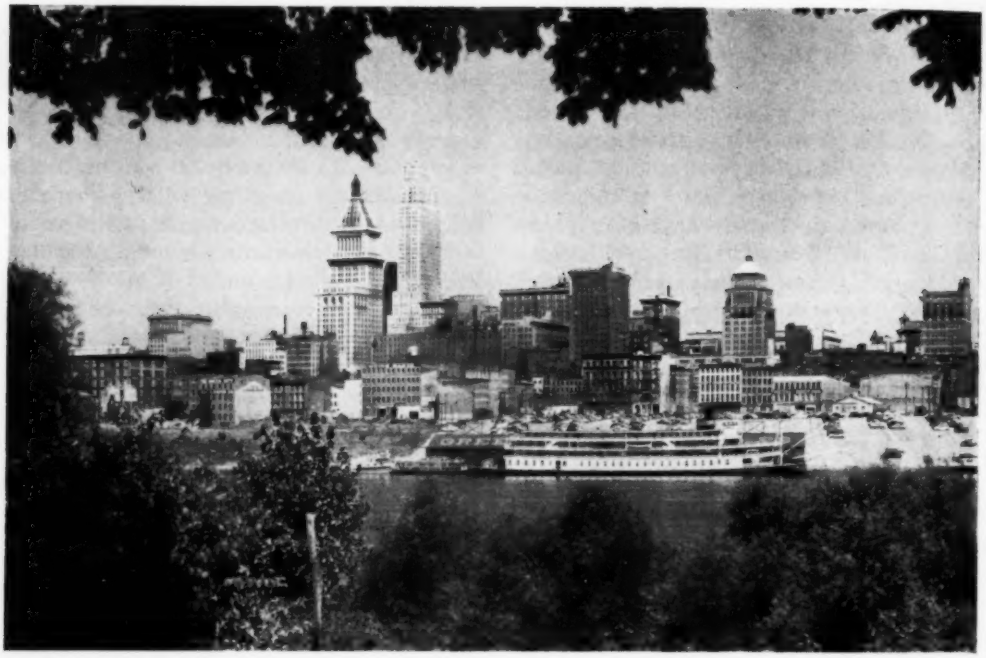
process, thus facilitating a proper approach for the surgeon and a proper definition of the possibilities of complete excision of the lesions.

Much of the discussion in recent years concerning the segments of the lungs and the bronchi have dealt with the terminology. Such studies have been discussed in previous editorials in this journal and need no further elucidation. It should be noted, however, that the thorough and brilliant investigations of Brock, of Jackson and Huber, and of Boyden and his associates have brought the segmental anatomy of the lung into a proper focus and made it possible for physicians interested in the chest to learn it with facility. The work of Boyden and his associates in pointing out the relationship of the vessels to the bronchi in the various segments and their demonstration of the numerous variations in the distribution of the bronchi has been particularly valuable, both to the surgeon and to the radiologist.

The paper by Kane in this issue calls attention vividly to the importance of thinking in terms of segmental anatomy when considering pathological processes in the lung. He presents an over-all picture of the distribution of the segments as seen in the simple postero-anterior roentgenogram alone. There are, however, as he himself has pointed out, certain defects in this approach. The overlapping of shadows of the segments is not easy to determine, and with the occurrence of atelectasis or emphysema, dislocations of the segments inevitably result. It should be emphasized to the fullest degree, therefore, that a postero-anterior view is only a scout film of the chest. Just as in mapping the bronchi with contrast medium it is important to get roentgenograms in a variety of positions, so in mapping the segments, without contrast, it is important to get views in a variety of positions. In most instances, multiple roentgenograms will suffice to determine with considerable accuracy the localization of any particular lesion. In some instances, however, body-section roentgenography will be enormously helpful in this enterprise. Anyone who has seen the brilliant lateral and postero-anterior sectional films made by Hugo Adler and by Robert Klopstock will appreciate how informative planigraphic or laminagraphic films can be, especially if they are made in both projections.

Radiologists should leave no stone unturned in pursuing the accurate localization of disease processes in the lungs. The picture of the segmental anatomy of the lung in the postero-anterior view, as delineated by Kane, should begin the process. Further investigation by all the available means should complete it. The accomplishments of the thoracic surgeon have created a whole new set of problems and responsibilities for the diagnostic roentgenologist. The technic of roentgen examination should match the thorough and painstaking technic of the surgeon who does resections of the lungs.

LEO G. RIGLER, M.D.



[Cincinnati, Ohio, where the Thirty-eighth Annual Meeting of the Radiological Society of North America will be held, Dec. 7–12, 1952.

ANNUAL MEETING
AMERICAN ROENTGEN RAY SOCIETY

The Fifty-third Annual Meeting of the American Roentgen Ray Society will be held at the Shamrock Hotel, Houston, Texas, Sept. 23–26. An outstanding program has been arranged by the President-Elect, Dr. Charles L. Martin, and his committee, and an excellent series of Instruction Courses by Dr. Harry M. Weber. The Caldwell Lecture will be given on Tuesday evening, Sept. 23, by Dr. Edward B. D. Neuhauser, Assistant Professor of Radiology, Harvard Medical School, and Radiologist-in-Chief at the Infants' and the Children's Hospitals, Boston. He will speak on "Growth Differentiation and Disease." On Wednesday evening a Film-Reading Session will be conducted, with Dr. Clyde A. Stevenson, of Temple, Texas, as Moderator. Participants will be Dr. Paul C. Hodges, of Chicago, Dr. Fred J. Hodges, of Ann Arbor, Mich., Dr. Merrill C. Sosman, of Boston, and Dr. C. Allen Good, of Rochester, Minn.

The Annual Golf Tournament is scheduled for Monday, Sept. 22, followed by the golf dinner at River Oak Country Club. The Annual Banquet will be held Thursday evening in the Emerald Room of the Shamrock.

PITTSBURGH ROENTGEN SOCIETY

At the meeting of the Pittsburgh Roentgen Society held June 11, 1952, the following officers were elected: President, Dr. William T. Rice; Vice-President, Dr. J. E. Malia; Secretary, Dr. Donald H. Rice; Treasurer, Dr. Newton Hornick; Councilor to the American College of Radiology, Dr. S. G. Henderson.

CONTINUATION COURSE
GASTROINTESTINAL ROENTGENOLOGY

The University of Minnesota will present a continuation course in Gastrointestinal Roentgenology for Radiologists, Oct. 20 to 25, 1952. The course will be presented at the Center for Continuation Study on the University campus and will cover all aspects of roentgenologic examination of the gastrointestinal tract. The distinguished visiting faculty members will include: Dr. Olle Olsson, Professor, Department of Diagnostic Roentgenology, University of Lund, Lund, Sweden; Dr. Richard R. Schatzki, Chief, Department of Roentgenology, Mt. Auburn Hospital, Cambridge, Mass.; Dr. Frederic E. Templeton, Professor, Department of Radiology, University of Washington Medical

School, Seattle; Dr. Paul C. Swenson, Professor, Department of Radiology, Jefferson Medical School, Philadelphia; Dr. Leon Schiff, Associate Professor, Department of Medicine, University of Cincinnati College of Medicine, Cincinnati. On Wednesday, October 22, the annual Leo G. Rigler Lecture will be presented by Dr. B. R. Kirklin, Professor, Department of Radiology, Mayo Foundation, Rochester, Minn.

The course will be presented under the direction of Dr. Leo G. Rigler, Professor and Head of the Department of Radiology and Physical Medicine, and the remainder of the faculty will include members of the clinical and full-time faculty of the University of Minnesota Medical School and the Mayo Foundation.

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES

Announcement was made on July 1 of the signing of a contract by the Atomic Energy Commission and the Oak Ridge Institute of Nuclear Studies providing for a continuation of the operation of certain programs by the Institute for the Atomic Energy Commission for another five years.

The Institute of Nuclear Studies was founded in 1946 with 14 charter member universities in the South and Southwest, a number that has increased in the interval to 30. Among the specialized programs carried on by the Institute are: a series of courses in the safe and efficient handling of radioactive isotopes; the operation of a long-range research program on the treatment of malignant diseases, with emphasis on the effects of radiation and the effects of radioactive materials on these diseases; and the operation of the American Museum of Atomic Energy, together with its traveling exhibits.

The Institute also sponsors several programs cooperatively with the Oak Ridge National Laboratory, which is operated by Carbide and Carbon Chemicals Co., and administers the fellowship program sponsored by the Atomic Energy Commission on a nationwide basis.

NATIONAL BUREAU OF STANDARDS NEW PUBLICATION

The recently issued *Handbook 51* of the National Bureau of Standards, *Radiological Monitoring Methods and Instruments*, is available on application to the Government Printing Office, Washington, D. C., for 15 cents. (Foreign remittances must be in U. S. exchange and should include an additional one-third of the publication price to cover mailing costs.)

This booklet of 33 pages, prepared by the Subcommittee on Monitoring Methods and Instruments of the National Committee on Radiation Protection, establishes some basic guides for methods of determining radiation hazards and of selecting suitable instruments for measuring them. It explains different types of radiation detectors, measuring instruments, and personnel monitoring instruments, and discusses instrument construction standards and characteristics required for these diverse purposes. Only those instruments which have proved useful in practice are considered.

General information is also given on hazard determination and control, airborne hazards, surface contamination, personnel monitoring, radiation-survey methods for radioactive-isotope monitoring and in medical and industrial installations, air and water sampling equipment and methods, and counting of alpha and beta particles.

U. S. ATOMIC ENERGY COMMISSION ISOTOPE DISTRIBUTION PROGRAM

The U. S. Atomic Energy Commission, in fiscal year 1953, is changing its previous policy of distributing radioisotopes for cancer research and therapy free of production costs. Instead, it will make a charge of 20 per cent of production costs. This change in policy affects only the price, and not the availability of isotopes; production will continue to meet all demands.

Distribution of radioisotopes free of production costs for cancer studies has proved an extremely helpful and valuable program, as evidenced by the fact that it has expanded rapidly and is continuing to expand. The program has fulfilled its objective of providing a strong stimulus to the fullest possible exploration of the usefulness of radioisotopes in cancer studies. It also has uniquely supplemented the extensive programs of cancer study supported by the American Cancer Society, the U. S. Public Health Service, and numerous privately endowed foundations and institutions.

The field has developed so rapidly that certain clinical applications of radioisotopes have now become a matter of routine, and research workers have become fully aware of the usefulness of these atomic tools in cancer research. The Commission's Advisory Committee for Biology and Medicine and Advisory Committee on Isotopes Distribution recently have advised that the stimulus of completely free distribution no longer is necessary to encourage the use of radioisotopes in the field of cancer. These committees have agreed with the view of the Atomic Energy Commission that a charge of 20 per cent of catalogue prices will not hamper advances in this field, and that it will help to indicate the future demand for radioisotopes in relation to other tools for cancer research and therapy.

The following table shows the prices per millicurie which will be charged, beginning July 1, 1952, for the four most important radioisotopes used in cancer research or therapy, as well as the prices for non-cancer use:

	Cancer Use	*Non-Cancer Use*
Radioiodine 131	$0.15	$ 0.75
Radiophosphorus 32	0.22	1.10
Radiogold 198	0.05	0.24
Radiocarbon 14	7.20	36.00

In applying for an authorization to receive radioisotopes, the applicant is requested to:

1. Complete an "Application for Radioisotope Procurement," Form AEC-313, for each radioisotope requested.
2. In addition to the prescribed information, include the following in Item 11, "Statement of Use," or on an attached sheet:
   a. The statement, "This application is for a radioisotope to be procured at a reduction of 80 per cent from the AEC or AEC distributed catalogue price and to be used in cancer . . . (research, diagnosis, therapy)."
   b. The statement, "The work will (will not) be done under a contract with the Atomic Energy Commission." Give contract number, if any.

Each shipment from a Commission distributor will be subject to the regular handling charge made to cover costs of packaging, monitoring, and accounting. Transportation charges will be paid by the purchaser.

Letter to the Editor

RADIATION HAZARDS FROM DIAGNOSTIC STUDIES

To the Editor of Radiology

DEAR SIR:

The paper of Russell and Russell on "Radiation Hazards to the Embryo and Fetus,"[1] appearing in the March 1952 issue of RADIOLOGY points out most clearly the hazards of radiation damage to the embryo and fetus. Their findings with mice graphically illustrate the caution radiologists must consider. As the authors rightly point out, it is highly unlikely that man would differ from all the animals investigated. On the other hand, the amount of radiation producing changes in one species will not necessarily evoke a similar response in another. It is an error to assume that the "dose-effect" may be directly transposed from animals to man. Available cases in the literature imply that similar damage does ensue from radiation in animals and man, but the amount of radiation required for damage in the latter is still unknown. These cases generally indicate that large doses are required.

If one should assume that the doses required were similar, then what conclusions could be drawn as to the danger of properly performed diagnostic radiographic studies? As Russell and Russell have so clearly illustrated, the human embryo-fetal sensitivity lies particularly in a critical period ranging from week two to six postconception, a time most women are not yet aware that they are pregnant. Radiation doses as low as 25 r during this critical stage will produce definite effects in the mouse. Russell and Russell state that this falls within the usual range of radiographic and fluoroscopic studies, quoting Sonnenblick *et al.* Such implication may be true in some cases. Certainly many (it should be all) radiologists refuse to tolerate such extremes. The table top measurement on this writer's fluoroscope ranges from 3.3 r to 4.8 r per minute with 3 ma., 80 kv., a 2-mm. Al added filter, and a fixed target-table top distance of 18 inches. All other diagnostic tubes have a 1-mm. added filter, and never less than a 36-inch target-film distance is used. These factors will drop the skin dose by as much as 400 per cent, when compared to a 30-inch target-film distance and no added filtration. Shielding and cones eliminate total-body irradiation (most easily given when filming infants) and further decrease the skin and depth dose. Several excellent papers and editorials have recently been published on protection during diagnostic studies, which may be consulted for details.

Using these routine precautions, the amount of radiation reaching a central depth in a human pelvis can be kept low, 0.1 to 1.2 r for abdominal films, pelvis, or pelvimetry. That which is scattered from a chest film to the pelvis is all but unmeasurable. If one were to accept the experimental animal data as true for man, damage to an embryo, even in the "critical stage," would be either exceedingly unlikely or would not occur. If such a conclusion were not acceptable, then ways and means to protect the embryo from cosmic rays must be devised. Statements to the contrary in the recent literature will be properly evaluated by the radiologist. On the other hand, the effects such statements would have on a lay jury could well be disastrous.

Women of the child-bearing age are not exempt from the ills and trauma of the human race. They cannot be denied the use of necessary radiographic studies, as suggested by some authors, because of the potential possibility of pregnancy. There is no question that good reason and judgment is to be used. In a known pregnancy, elective radiographic studies are to be condemned, certainly postponed beyond the first trimester. Other indicated radiographic studies may be performed with safety, if normal precautions, protection devices, and intelligent discretion are used.

GEORGE W. HENRY, M.D.
Honolulu, T. H.

EDITORIAL NOTE: The only way of knowing what dosage is delivered to the fetus is:

1. Make measurements of the *quality and quantity* of output of machines.
2. Calculate the dosage for different positions

[1] Russell, L. B., and Russell, W. L.: Radiation Hazards to the Embryo and Fetus. Radiology **58**: 369–377, March 1952.

and thickness of patients from physical isodose charts (or approximations from depth-dose tables, corrected for size of field).

3. Make corrections for probable inclusion or exclusion of the uterine contents in the primary beam. This is particularly important in fluoroscopy because in good practice the shutters are kept closed as far as possible and the patient is constantly turned into different positions.

Under the worst circumstances in which a woman could be studied in the critical period of pregnancy (second to sixth week if we can accept the inference of this work), it is conceivable that 25 r could be delivered to the fetus. This would entail a combination of bad judgments as follows:

1. Poor or insufficient training in radiology.

2. Ignorance of the *potential* dangers of fetal irradiation. (This is the point in which Russell and Russell have done valuable service in defining dangerous levels—though they have stepped beyond their knowledge and experience in applying it too far to radiographic practice.)

3. Ignorance of unusually high and dangerous output of radiographic and fluoroscopic machines. (No physical output determinations.)

4. A formidable series of diagnostic procedures done under poor technical methods (with fluoroscopic shutters wide open—which greatly reduces visibility—without prolonged time of observation). This would have to be supplemented with quite an array of film exposures.

These errors of judgment seem unlikely with a well trained radiologist. There has never been any complete protection against the possibilities of radiation damage of all types in the hands of the unskilled, and this instance is no exception. There is also the possibility of the situation arising in which the probable danger level may be exceeded purposefully for adequate clinical indication by radiologists familiar with the potential hazards.

The paper of Russell and Russell is a valuable contribution to our knowledge of a specific radiation hazard. Their appreciation of its application to clinical radiology is limited and inadequate. Dr. Henry's objections are understandable and, on the whole, well taken; but the crux of the matter still lies with the education and experience of the user of ionizing radiations. R.H.C.

Books Received

ROENTGENOLOGY IN OBSTETRICS AND GYNECOLOGY. By WILLIAM SNOW, M.D., Chief Radiologist, Veterans Hospital; Consulting Radiologist, Willis-Knighton Memorial Hospital and Clinic, Shreveport, La.; formerly Director of Roentgenology, The Harlem Hospital and The Bronx Hospital, New York, N. Y. A volume of 364 pages, with 305 illustrations. Published by Charles C Thomas, Springfield, Ill., 2d ed., 1952. Price $10.50.

SYMPOSIUM ON RADIOBIOLOGY. THE BASIC ASPECTS OF RADIATION EFFECTS ON LIVING SYSTEMS. (Oberlin College June 14–18, 1950). Edited by JAMES J. NICKSON. Editorial Committee: P. Morrison, M. Burton, E. S. Guzman Barron, G. Failla, and H. M. Patt. Sponsored by The National Research Council of the National Academy of Sciences. A volume of 466 pages, with 109 illustrations. Published by John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London, 1952.

ULTRAVIOLET RADIATION. By LEWIS R. KOLLER, Ph.D., Research Associate, General Electric Research Laboratory, Schenectady, N. Y. A volume of 270 pages, with 77 tables and 148 figures. Published by John Wiley & Sons, Inc., New York, 1952. Price $6.50.

SELECTED PAPERS FROM THE ROYAL CANCER HOSPITAL AND THE CHESTER BEATTY RESEARCH INSTITUTE 1948–1949. Published by order of the Board of Governors of the Royal Cancer Hospital, London. Volume 6, containing an Accumulated Author Index for Vols. 1–6, covering 1935–1949. A volume of 616 pages. London, 1952.

LÉSIONS NOUVELLES DU POIGNET. PSEUDOKYSTES NÉCROBIOTIQUES, KYSTES PAR HERNIATIONS CAPSULAIRES, ARTHRITE CHRONIQUE DÉGÉNÉRATIVE PAR OSTÉOCHONDROSE MARGINALE. Acta Radiologica Supplement 90. By JEAN-PIERRE BUGNION. From the Institut de Pathologie de Genève (Director: Prof. E. Rutishauser). A monograph of 124 pages, with 46 illustrations. Published by Acta Radiologica, Stockholm 2, Sweden, 1952. Price Sw. Kr. 20:—.

THE UTERINE CERVIX AND ISTHMUS UNDER NORMAL AND PATHOLOGICAL CONDITIONS. A CLINICAL AND ROENTGENOLOGICAL STUDY. Acta Radiologica Supplement 91. By JAN ASPLUND. From the Department of Women's Diseases (Prof. Axel Westman) and the Department of Diagnostic Roentgenology (Prof. Åke Åkerlund), Karolinska Sjukhuset, Stockholm. A monograph of 76 pages, with 11 tables and 60 figures. Published by N. O. Mauritzons Boktryckeri, Stockholm 2, Sweden, 1952. Price Sw. Kr. 20:—

CARCINOMA OF THE UTERINE CERVIX: INCIDENCE AND INFLUENCE OF AGE. A STATISTICAL STUDY. Acta Radiologica Supplement 92. By ARNE LINDELL. From the Gynecological Department (Director: Hans-Ludvig Kottmeier) of the Radiumhemmet, Stockholm. A monograph of 102 pages, with 18 figures and 38 tables. Published by Acta Radiologica, Stockholm 2, Sweden, 1952. Price Sw. Kr. 20:—.

CONTRIBUTIONS TO THE THEORY AND TECHNIQUE OF QUANTITATIVE AUTORADIOGRAPHY WITH P^{32} WITH SPECIAL REFERENCE TO THE GRANULOSA TISSUE OF THE GRAAFIAN FOLLICLES IN THE RABBIT. Acta Radiologica Supplement 93. By ERIK ODEBLAD. From the Gynecological Clinic (Head: Prof. Per Wetterdal) of the Karolinska Institutet, Sabbatsberg Hospital, Stockholm, Sweden. A monograph of 124 pages, with 54 figures, and 8 tables. Published by Acta Radiologica, Stockholm 2, Sweden, 1952. Price Sw. Kr. 20:—.

MASS, LIPIDS, PENTOSE NUCLEOPROTEINS AND PROTEINS DETERMINED IN NERVE CELLS BY X-RAY MICRORADIOGRAPHY. Acta Radiologica Supplement 94. By SVEN-OLOF BRATTGÅRD and HOLGER HYDÉN. From the Department of Histology, The Medical School, Göteborg, Sweden. A monograph of 48 pages, with 22 figures and 6 tables. Published by Elanders Boktryckeri Aktiebolag, Göteborg, 1952. Price Sw. Kr. 15:-.

TRATTATO DI STRATIGRAFIA. By PROF. A. VALLEBONA, with the collaboration of PROF. P. AMISANO, PROF. G. BALESTRA, PROF. E. VITALE, DR. A. DE MAESTRI, DR. G. GARDELLA, DR. N. MACARINI, DR. L. OLIVA, DR. A. PASSERI, DR. F. PERASSI, DR. A. PIAZZA, DR. A. ROLLANDI, DR. G. SANQUIRICO, and DR. R. VIGNOLINI. A volume of 348 pages, with 290 figures. Casa Editrice Dottor Francesco Vallardi, Milan, 1952.

Book Reviews

GRUNDLAGEN DER STRAHLENTHERAPIE: PHYSIK BIOLOGIE UND ALLGEMEINE THERAPIE. By Dr. Med. RICHARD KURT KEPP, Apl. Professor für Gebürtshilfe und Frauenheilkunde an der Universitäts-Frauenklinik Göttingen. With 134 illustrations. Published by Georg Thieme, Stuttgart, Germany, 1952. Distributors for U.S.A. and Canada: Grune & Stratton, Inc., New York, N. Y.

This rather comprehensive treatise on the foundations of radiation therapy was written by a gynecologist. It comprises three main parts, dealing respectively with radiation physics, radiation biology, and radiation therapy. The last section is subdivided into chapters on the effect of radiations on tissues, on single organs, and on malignant tumors.

A short but informative historical review forms the introduction to the text. This is followed by a lengthy chapter on the physical foundations of radiation therapy. This chapter is written in easily understandable language, including no mathematics. It covers, therefore, only the essentials and follows conventional lines. In addition to ordinary x-ray equipment, a supervoltage apparatus (1,000 kv.) and a betatron (6 mev and 15 mev) of German manufacture are described and illustrated. A picture of a Van de Graaff 2-mev electrostatic generator is shown, while the 24-mev Allis Chalmers betatron and the 30-mev synchrotron in the London Royal Cancer Hospital are mentioned in a few words.

A number of German dosimeters are described, ranging from the Kuestner free-air ionization chamber to microchambers which can even be introduced into the bladder. Dosage distribution within the irradiated body and isodose curves are presented, and two sample pages of the depth dosage table series of Grebe are given. A comparison of Grebe's percentage depth dose at 10 cm. given on one of these tables with the corresponding value carefully measured by Quimby reveals that Grebe's depth dose is about 12 per cent higher than Quimby's.

Considerable space is devoted to the discussion of special methods of therapy, such as contact therapy, "half-depth therapy," etc., and numerous illustrations of the equipment used, as well as the depth dose distribution for these short-distance treatment technics, are offered. There follows an interesting discussion of the various treatment methods with 200-kv. radiations, such as the cross-fire technic, rotation, pendulum, and convergence procedures.

Natural and artificial radioactivity are discussed and methods of measurement, dosage, and treatment are presented. One is somewhat surprised not to find any mention of the Paterson-Parker or the Quimby dosage system and charts either in this chapter or in the subsequent clinical chapter on radium dosage. The discussion of radioactive isotopes is followed by short chapters on the possible use of cathode rays, neutrons, protons, and deuterons in radiation therapy.

In the biological section the author offers a great deal of experimental material to explain the fundamental processes that take place when living tissue is irradiated. He discusses especially the *Treffer* or hit theory, the importance of the wave length of the radiation for the biological effect, specific ionization, protraction and fractionation, and dosage distribution. Morphological and functional as well as physicochemical changes of cells and tissues after irradiation are described and illustrated. Specific sensitivities, inflammatory reactions, and chronic changes are demonstrated. In the chapter on the effects of radiation upon single organs the author selects the skin, connective tissue, muscles, bones, vagina, uterus, ovaries, breast, bladder, rectum, kidney, spleen, hypophysis, thyroid, adrenals, and lung, and describes the effects of radiation upon each of these. A chapter follows, dealing with radiation effect upon genes and the offspring in general, upon the sperm and the ovum, upon blood, nerves, and general constitution.

The book closes with a detailed chapter on radiation treatment of malignant tumors, with specific suggestions for the type of radiation to be used, the technic most advisable for individual conditions, dosage and dosage distribution.

A bibliography covering 36 pages is appended, but contains only a minute number of American references.

The author has collected a large amount of material, some of it obsolete, for this book, and many parts make interesting reading. For this reason the clinical and biological parts are better than the technical and physical parts. The radiologist who looks for specific information on how to determine surface or depth doses or how to arrange and combine radium needles or tubes or seeds for a given treatment will have great difficulty, or even fail, in finding what he requires. As a general source of information on many of the physical, biological, and clinical foundations of radiation therapy the book can be recommended.

MEDIZINISCHE RÖNTGENTECHNIK. LEHRBUCH FÜR MEDIZINISCH-TECHNISCHE ASSISTENTINNEN, STUDIERENDE UND ÄRZTE. Edited by DR. HERBERT SCHOEN, Chief of the Central Roentgen Institute, Municipal Hospitals, Karlsruhe. II. Teil. (1) Grundlagen der Strahlendiagnostik und Strahlentherapie, Apparatekunde. By DIPL. PHYSIKER ERICH BUNDE, Karlsruhe. (2) Röntgen- und Farben-photographie. By DR. VIKTOR LOECK, Wuppertal-Elberfeld. A volume of 360 pages, with 217 illustrations. Published by Georg Thieme, Stuttgart. Distributors for U. S. A. and Canada: Grune & Stratton, Inc., New York. Price DM 27.

This book is written by two physicists and is largely based on material used in instruction courses for medical technicians by Herbert Schoen at radiological teaching centers in Dresden and Karlsruhe. It is therefore non-mathematical and serves well as an elementary introduction into the fields of roentgen diagnosis and therapy, radium and isotope therapy, and medical photography. The second part of the book on Roentgen and Color Photography, written by Viktor Loeck, covers 90 pages. It is an excellent presentation of the fundamental aspects of roentgen photography. It covers the field from the original photographic material and equipment to the production of the picture and its preservation. Darkroom technic is described in detail, possible errors and mistakes are carefully explained, and numerous recipes and informative tables are presented.

The first part of the book, "Foundations of Radiation Diagnosis, Radiation Therapy and Apparatus," written by Erich Bunde, comprises 235 pages. Most of this space is devoted to a conventional but well presented discussion of fundamental electricity, atomic physics, nature and property of roentgen rays, diagnostic roentgen technic, roentgen apparatus and tubes, roentgen dosimetry, and protection. There are a few short chapters on natural and artificial radioactivity, Geiger counters (2 pages), and dosimetry of gamma rays (2-1/2 pages).

The book is very well printed and for the most part excellently illustrated. There are few printing errors; the incorrect atomic weights of iron and protactinium are examples. Rules for radiation protection given in the text are partly obsolete, since they are still based upon an old tolerance dose, which is about five times as large as the internationally accepted permissible dose used at present. None of the many books on radiological physics and technic published in the United States and England during the last decade are included in the bibliographies, although they contain discussions of certain phases of radiology which are well ahead of the present German text.

GESCHWÜLSTE DES OHRES UND DES KLEINHIRNBRÜCKENWINKELS. By DR. MED. K. GRAF, Priv.-Doz, für Ohren-Nasen-Halsheilkunde an der Universität Zürich. A monograph of 284 pages, with 132 illustrations. Published by Georg Thieme, Stuttgart, Germany, 1952. Distributors for U.S.A. and Canada: Grune & Stratton, Inc., New York, N. Y.

Almost three-fourths of the text of this volume on Tumors of the Ear and Cerebellopontine Angle, 190 of the 260 pages, is devoted to acoustic neurinoma and acoustic neurofibroma. The author's detailed description of eighth nerve tumors, particularly the anamnesis and clinical features, exceed anything extant. The characteristic sequence of ear noises, hearing loss, vestibular disturbance, followed by disturbances of the neighboring nerves, and then signs of increased intracranial pressure, is emphasized. Sections on pathology, etiology, pathogenesis and therapy precede some two score individual case reports. Of the closing chapters, which deal with less frequent tumors and disorders of this region, the best is that on the recently discovered glomus tumor of the middle ear.

Each section includes a review of items from the literature, a few paragraphs of didacticism, then a summary of findings in the author's cases.

Roentgenologically, the book leaves something to be desired. The roentgenology of the petrosa is treated in rather cursory fashion. The Stenvers' projection alone is recommended. The films reproduced are largely those of cadaver specimens and are not truly equivalent to roentgenograms of the living. In quality the illustrations are average. A further criticism is that 40 cases of acoustic neurinoma fail to meet the competition in so far as statistical analysis is concerned. Cushing originally presented 190 cases (Tumors of the Nervus Acusticus and the Syndrome of the Cerebello-pontine Angle. Philadelphia, W. B. Saunders Co., 1917). More recently Hodes, Pendergrass and Dennis reported on 126 true acoustic neurinomas (Radiology **57**: 395–406, 1951).

The work will be of value to the neuropathologist, of less worth to the neurosurgeon, and of relatively little use to the practising radiologist.

MANUEL DE RADIOLOGÍA CLÍNICA. By JUAN JOSÉ QUEZADA R., Professor of Radiology and Physiotherapy in the National School of Medicine, Mexico City. A volume of 254 pages with 230 illustrations. Published by Dr. J. Quezada, Av. Schiller 110, Mexico, D. F. Apartado Postal 28929. Price $8.00 (U.S. currency).

Feeling the lack of up-to-date radiologic texts in Spanish for handy reference by the radiologist and technician in their actual daily work, the author has produced a commendable publication representing the classic type of textbook, adequately illustrated with reproductions of roentgenograms and numerous explanatory drawings. Within the limits of 250 pages of text there is compressed a mine of information which should serve to elevate the standard of radiologic diagnostic practice in Mexico and other Spanish-speaking countries. Special attention has been given to what the author terms the Mexican "school" of radiology, though not omitting due reference to foreign authorities. Most of the illustrations were derived from the Hospital Juarez.

In Memoriam

MAURICE A. LOEBELL, M.D.
1882–1952

Dr. Maurice A. Loebell, of Zanesville, Ohio, died on March 17, 1952, at the age of sixty-nine.

Dr. Loebell was born in Rumania. He was graduated from the Eclectic College of Physicians and Surgeons, Indianapolis, in 1912, and after a brief period of practice, saw service in World War I. Upon the completion of the war he established himself in Zanesville, where he remained until his death.

Dr. Loebell was a member of the Ohio State Medical Association, the American Medical Association, and the Radiological Society of North America. He was secretary of the Muskingum County Medical Society in 1920–21. Among non-medical organizations with which he was affiliated were the American Legion, several Masonic orders, Kiwanis Club, the Elks, and the Methodist Church. Surviving are his widow, two daughters, and a son.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., 635 Herkimer St., Pasadena 1, Calif.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 15 East Monroe, Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Calvin L. Stewart, M.D., 2330 First Ave., San Diego.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, John B. Hamilton, M.D., 210 N. Central Ave., Glendale 3. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, G. A. Fricker, Sacramento Co. Hospital, Sacramento 17. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, Rex Uncapher, M.D., 7720 Girard Ave., La Jolla. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly, at the University Club.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, Ford Shepherd, M.D., 526 Soquel Ave., Santa Cruz. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Charles E. Duisenberg, M.D., Palo Alto Clinic, 300 Homer Ave., Palo Alto. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Wendell P. Stampfli, M.D., 1933 Pearl St., Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meets bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, B. Bruce Alicandri, M.D., 20 Maple St., Springfield, Mass. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, U. V. Wilcox, M.D., 915 19th St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. Judson Graves, M.D., 2002 Park St., Jacksonville. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, Maurice Greenfield, M.D., Ingraham Bldg., Miami. Meets monthly, third Wednesday, 8:00 P.M., Veterans Administration Bldg., Miami.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Rayle, Jr., M.D., 478 Peachtree St. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert M. Tankesley, M.D., 218 Doctors Bldg., Atlanta. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary*, Col. Alexander O. Haff, Tripler Army Hospital, Honolulu. Meets monthly on the third Friday, at Tripler Army Hospital.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Elbert K. Lewis, M.D., 6337 S. Harvard Ave., Chicago 21. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, John A. Robb, M.D., 23 East Ohio St., Indianapolis. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*. James McMillen, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and holds a scientific session in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Charles M. White, M.D., 3244 East Douglas, Wichita 8. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston. Meets three times a year—Spring, Summer, and Fall.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, Richard B. Hanchett, M.D., 705-6, Medical Arts Bldg., Baltimore 1. Meets third Tuesday, September to May.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 621 High St., Jackson 2, Miss. Meets monthly, third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Sidney Rubin, M.D., 410 Professional Bldg., Kansas City, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Francis O. Trotter, Jr., M.D., 634 North Grand Blvd., St. Louis 3. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Russell W. Blanchard, M.D., 1216 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Stanley M. Wyman, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Nicholas G. Demy, M.D., 912 Prospect Ave., Plainfield. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 8:45 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Joseph J. La Vine, M.D., 259 North Grand Avenue, Baldwin, N.Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Harold W. Jacox, 622 W. 168th St., New York 32.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John F. Roach, M.D., Albany Hospital, Albany. Meets at University Club, Albany, second Wednesday, October, November and March. Annual meeting in June.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Robert J. Bloor, 260 Crittenden Blvd. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary*, Walter J. Brown, M.D., Northern Westchester Hospital, Mount Kisco, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, Waldemar C. A. Sternbergh, 1400 Scott Ave., Charlotte 2. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, H. Milton Berg, M.D., Quain & Ramstad Clinic, Bismarck. Meets in the Spring with State Medical Association and in the Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Willis S. Peck, M.D., 1838 Parkwood Ave., Toledo 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Harry K. Hines, M.D., 2508 Auburn Ave., Cincinnati 19. Meets first Monday of each month, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Geo. A. Nicoll, M.D., Miami Valley Hospital, Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Danstrom, M.D., Medical Arts Bldg., Oklahoma City.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Richard Raines, M.D., Medical-Dental Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., American Oncologic Hospital, Philadelphia 4. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Donald H. Rice, M.D., West Penn Hospital, Pittsburgh 24. Meets monthly, second Wednesday at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY *Secretary-Treasurer*, Maurice D. Frazer, M.D., 1037 Stuart Bldg., Lincoln, Nebr.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Henry E. Plenge, M.D., 855 N. Church St., Spartanburg. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, John E. Whiteleather, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., Newell Hospital, Chattanooga 2. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, Claude Williams, M.D., Fort Worth. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Frank M. Windrow, M.D., 1205 Hermann Professional Bldg.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Building, San Antonio 5, Texas. Meets at Brook Army Medical Center, the first Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Jan. 23–24, 1953, San Antonio.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John N. Burkey, M.D., 555 Medical-Dental Bldg., Seattle. Meets fourth Monday, September through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club.

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Irving I. Cowan, M.D., 425 East Wisconsin Ave., Milwaukee 2.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, Jean Bouchard, M.D. Assoc. Hon. Secretary-Treasurer, D. L. McRae, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 26, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, Mexico, D.F. Meets first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R. de P.

PUERTO RICO

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542 Santurce, Puerto Rico.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Cerebral Angiography in Abscess of the Temporal Lobe. P. H. Schurr. Brit. J. Surg. **39:** 156–165, September 1951.

In the last six years angiography has been performed at the Radcliffe Infirmary, Oxford, in 30 patients who were found to be suffering from cerebral abscess. In 12 cases the abscess was situated in the temporal lobe. In no instance were there any ill effects which could be attributed to the procedure. Most of the patients were first treated by aspiration of the abscess through a burr hole, with instillation of penicillin and Thorotrast. Pyograms were then taken at intervals and further aspirations performed when indicated.

Percutaneous puncture of the common or internal carotid artery in the neck is done under local anesthesia. Diodone (pyelosil glaxo), 10 to 12 c.c. of a 35 per cent solution, is the contrast medium used, and the radiographs are taken in anteroposterior and lateral projections, two, four, and eight seconds after the injection is begun. This medium should be avoided in patients with cardiac or renal disease and in those who are sensitive to iodine.

In space-occupying lesions within the cranium the vascular pattern as seen in the normal arteriogram is altered. In the anteroposterior view the features of a temporal lobe abscess are a shift of the anterior cerebral artery to the opposite side, and often a shift of the great vein of Galen in the same direction. The middle cerebral artery is usually elevated in its first part, especially when the abscess is anterior. The lateral view shows elevation of the middle cerebral group of vessels and an area in the temporal lobe may appear relatively avascular. The normal distance of these vessels above the horizontal portion of the carotid siphon is taken to be 1 cm., and the degree of displacement is the increase in this distance. The shape of the distortion may give further information as to the precise location of the abscess in the middle fossa, the greatest displacement or stretching being above the abscess.

The volume of the lesion, including the surrounding edema, was found to be proportional to the shift of the middle cerebral vessels. On the other hand, there was no relationship between the gross volume of the abscess and the displacement of the anterior cerebral vessels.

A temporal lobe abscess may present in one of the following four ways: (1) intracranial symptoms may follow mastoid infection; (2) there may be an increase in intracranial pressure of undetermined origin; (3) a cryptic brain abscess may be associated with meningitis; (4) a protracted mastoid infection may fail to show improvement. An example is given of each of these types.

Conditions to be considered in the differential diagnosis include extradural and subdural abscess, petrositis, cerebral thrombophlebitis, sinus thrombosis, cerebellar abscess, abscess of the other parts of the cerebral hemisphere, localized hydrocephalus of the inferior horn of the lateral ventricle, and neoplasm. In most brain tumors angiography reveals some part of the tumor circulation. Angiomas, meningiomas, glioblastomas, and some other neoplasms often show widespread evidence of their abnormal vasculature. Cystic or avascular neoplasms, particularly astrocytomas, may be more difficult to differentiate.

Repeated angiography did not appear to harm the patients.

Eighteen illustrations, including 6 roentgenograms.

MORTIMER R. CAMIEL, M.D.
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Subdural Hematoma, Hygroma, and Hydroma in Infants. Gordon Kinley, Harris D. Riley, Jr., and Claude S. Beck. J. Pediat. **38:** 667–686, June 1951.

Abnormally large quantities of subdural fluid over the convexity of the cerebral hemispheres may be termed hematomas, hygromas, or hydromas. These may be distinguished by the appearance and extent of the fluid and pathological changes in the adjacent meninges. Clinically, their behavior is similar in that all are slowly progressive space-occupying lesions which cause diffuse pressure on the underlying brain.

All of the 22 infants in this study had experienced falls, with varying degrees of head injury. In 16 there was a history of prematurity, prolonged labor, abnormal presentation, difficult forceps delivery, or cesarean section. The symptoms were extremely varied. The signs all pointed to increased intracranial pressure with variable impairment of cerebral function.

The term chronic subdural hematoma is used to indicate bloody and/or xanthochromic fluid encapsulated by a well defined neomembrane. Hygroma indicates a collection of xanthochromic fluid free in the subdural space with a non-encapsulating neomembrane, and hydroma a collection of colorless or slightly xanthochromic fluid free in the subdural space with no evidence of a neomembrane. These distinctions are made as a guide to surgical treatment.

Special diagnostic studies include subdural punctures to establish the presence or absence of subdural fluid in abnormal amounts and spinal punctures for purposes of comparison. In those cases in which there is any element of doubt, the subdural fluid should be replaced by oxygen and films obtained with the head in the erect, face up and down, and lateral positions. This should not be done, however, until the fluid has been greatly diminished by punctures. A localized dilatation of the subdural space will indicate a hematoma; a generalized dilatation will suggest a hygroma if the fluid is xanthochromic or a hydroma if the fluid is clear.

Eleven roentgenograms; 5 photomicrographs; 4 photographs.

PAUL W. ROMAN, M.D.
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Residual Calcification of the Glomera of the Choroid Plexus as an Indication of Spontaneous Healing of Congenital Toxoplasmosis of the Central Nervous System. J. Schoeps. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 335–338, September 1951. (In German)

Many cases of congenital (intrauterine hematogenous) infection by *Toxoplasma* are unidentified and may be symptomless or show only vague and uncertain clinical signs. Occasionally the sole evidence of such condition may be calcification within the choroid plexuses, which is often encountered as an incidental or accidental finding. It is possible that the condi-

tion may be latent in the mother and become active in the child.

Other residual manifestations of spontaneous healing of toxoplasmosis are multiple disseminated calcifications within the brain substance and in the basal ganglia, but in several of the author's cases the only findings were calcification within the glomera of the choroid plexuses. Confirmatory evidence may be obtained by serological tests.

Three roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Morgagni's Syndrome and Brain Tumors. A Note. Sherwood Moore. J. Neurosurg. **8:** 480–481, September 1951.

In the course of a study of idiopathic symmetrical hyperostosis of the skull, an essential feature of Morgagni's syndrome, especial attention was attracted to associated and complicating diseases. Roentgen examination was made of the skulls of 10,064 individuals of all ages, 5,188 females and 4,876 males. Among them were 627 females and 55 males having hyperostosis. For a control, skulls of 1,073 consecutive patients free of all evidence of hyperostosis were studied in an identical fashion. These included 450 females and 623 males. The records of the patients were analyzed for the purpose of studying the coexistence of hyperostosis and intracranial tumor.

The incidence of tumor in the female patients having hyperostosis was 6.22 per cent, and in the controls 6.14 per cent. For the males, the values were 2.27 per cent and 7.86 per cent respectively. There was a slight preponderance of meningeal fibroblastoma in the females with hyperostosis as compared to the controls. Except for this, there was no evidence of any significant relationship between hyperostosis and intracranial neoplasm.

One table. HOWARD L. STEINBACH, M.D.
University of California

Suprasellar Tumours with Calcification. Erik Lindgren and Giovanni Di Chiro. Acta radiol. **36:** 173–195, September 1951.

By many observers the occurrence of suprasellar calcification is held to be indicative of craniopharyngioma. The authors point out, however, that while there is indeed a high incidence of roentgenographically demonstrable calcification in craniopharyngiomas (55 per cent in their series of 54 cases), such a finding is by no means pathognomonic of that condition. They found it also in 50 per cent of 14 cases of suprasellar gliomas (9 of the optic chiasm and 5 of the hypothalamus). In craniopharyngiomas the calcification may be cystic or nodular; in the gliomas it is nodular.

Plain roentgenograms of the skull give little information when there is a question of differentiation of the suprasellar gliomas with calcification from craniopharyngiomas with nodular calcification. Widening of the optic foramina, increased convolutional markings, and separation of cranial sutures are more frequently seen with suprasellar gliomas than with craniopharyngiomas. Pneumography, however, is essential for a differential diagnosis. The suprasellar gliomas push the third ventricle markedly backward and sometimes bulge into its anterior border. They have never been seen by the authors to bulge into the inferior contour of the third ventricle between the two anterior recesses, as do the craniopharyngiomas. The contour, on the contrary, is often straightened, and the two recesses are compressed from in front.

Other lesions in which calcification is less frequently observed include pituitary adenomas, suprasellar meningiomas, chordomas, cholesteatoma, aneurysms in the sellar region, and old hematomas. These are easier of differentiation because of the typical appearance of the calcifications and their location.

Twenty-eight roentgenograms; 4 drawings.
R. W. DICKENHORST, M.D.
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Massive Cerebral Infarction Producing Ventriculographic Changes Suggesting a Brain Tumor. Arthur B. King. J. Neurosurg. **8:** 536–539, September 1951.

Thrombosis of intracranial arteries is not ordinarily associated with a rise in intracranial pressure. Edema and swelling may occur with cerebral softening for a period of time, but usually they do not produce symptoms of elevated intracranial pressure.

A case history is presented of a patient who had sustained a thrombosis of the right internal carotid artery together with complete occlusion of the anterior and middle cerebral systems on the same side. Roentgenograms of the skull revealed that the pineal was displaced to the left about 3 mm. Cerebral arteriograms demonstrated absence of filling of the anterior and middle cerebral arteries on the right side. Ventriculograms revealed a shift to the left, suggesting a mass in the frontoparietal region of the right cerebral hemisphere. In view of the displacement of the ventricular system and the slow onset of symptoms, the possibility of a neoplasm was considered and surgery was performed. It was found that the brain was under moderate tension and almost entirely necrotic. The blood vessels in the sylvian fissure were thrombosed along their entire course. The anterior cerebral artery, too, was thrombosed throughout its length. The area of necrosis extended down into the basal ganglia and into the corpus callosum.

This case is presented as an example of how an extensive thrombotic softening, with swelling of the necrotic tissue, may mimic a tumor. When the history, physical findings, and x-ray studies appear to point toward a slowly developing intracranial neoplasm rather than a cerebrovascular accident, the problem of differential diagnosis is even more difficult.

Four roentgenograms.
HOWARD L. STEINBACH, M.D.
University of California

Intracranial Epidermoid Cyst. Franz Leidler, David E. Smith, and Robert D. Woolsey. Am. J. Clin. Path. **21:** 852–857, September 1951.

A case is reported in which a large epidermoid cyst arose near the pineal body and produced advanced atrophy of the cranial bones, particularly in the frontal and parietal regions. Pneumoencephalography revealed distortion of the mid portion of the lateral ventricles and of the third ventricle by a large irregular soft shadow without lateral displacement. Ventriculograms taken ten, thirteen, and twenty-two days after the pneumoencephalographic examination, showed partial obliteration of the mid parts of both lateral ventricles by an interventricular mass. Anterior and posterior horns of the lateral ventricles and the third

ventricle showed marked dilatation. There was no air in the sylvian aqueduct and the fourth ventricle.

The clinical and pathological findings gave evidence of extensive anatomic and physiologic adjustments to the presence of this slowly expanding cyst.

Two roentgenograms; 2 drawings; 1 photomicrograph.

Intracranial Complications of Congenital Dermal Sinuses. Donald D. Matson and Franc D. Ingraham. Pediatrics **8**: 463–474, October 1951.

Ten cases are reported in which intracranial extension of a congenital dermal sinus was disclosed by operation. In 9 patients the sinus led into the posterior cranial fossa and in 1 into the anterior fossa.

The symptoms and signs of congenital dermal sinus may be divided into two groups, those referable to the scalp sinus itself and those attributable to intracranial complications.

In or close to the midline a small dimple or sinus opening is usually seen. Often one or more hairs protrude from the sinus, and there may be an absence of normal hair in an area 1 or 2 mm. in width adjacent to the opening. It may sometimes be impossible to see such a dimple until the area is shaved and examined under a good light. In most cases there has been, in addition, thickening of the scalp in this region or an actually palpable, movable, subcutaneous mass.

Intracranial complications include those due to the presence of a mass and those resulting from intracranial infection. In some instances the clinical picture has been a combination of both. Five of the authors' patients had symptoms and signs indicating a mass lesion in the posterior fossa. In 2 of these, the tract from the skin was not discovered until operation for suspected cerebellar tumor; in the other 3, skin lesions and bone defects were found during the preoperative investigation. In 2, the posterior fossa mass proved to be a large abscess associated with a dermoid cyst in the cerebellum, and in the other 3 there was a cyst without abscess formation. One patient had an acute osteomyelitis of the frontal and nasal bones. Meningitis was a primary feature in 5 patients, and in unexplained meningitis the entire midline area of the skin over the neural axis should be examined carefully for dimples, palpable thickening, or sinus openings.

A defect was demonstrable at operation in all of the authors' cases and roentgenographically in 6. Occasionally the path through the bone was little more than 1 mm. in diameter and it passed at such an angle that it was not readily seen in the conventional roentgenographic views. Usually, however, a definite, smoothly outlined, circular midline defect of varying size was visible, particularly in the occipital projection. It is probable that satisfactory roentgenograms will almost always reveal the path of the sinus through the skull if they are studied with this in mind. The authors believe that ventriculography which demonstrates symmetric hydrocephalus of the lateral and third ventricles in the presence of an occipital dermal sinus tract implies that this tract expands to a cystic obstructing lesion within the posterior fossa.

The treatment of choice is surgical excision of the entire dermal sinus tract from the skin surface to its deepest projection, including all cystic expansions, before infection has occurred, or at least at a time when no infection is present. Therefore, when x-ray examination demonstrates a defect in the bone, or when there is any indication of increased intracranial pressure, excision of a dermal sinus in the scalp should include preparation to carry out intracranial exploration as well. In the 4 cases in this series properly diagnosed only after severe infection had occurred, results were unsatisfactory. The other 6 patients are alive and asymptomatic from six months to eight years after surgery.

Eight illustrations, including 1 roentgenogram; 1 table.

Thrombosis of the Dural Venous Sinuses as a Cause of "Pseudotumor Cerebri." Bronson S. Ray and Howard S. Dunbar. Ann. Surg. **134**: 376–386, September 1951.

The authors recently studied by sagittal sinus venography four patients presenting the peculiar syndrome known as "pseudotumor cerebri." By this method they were able to demonstrate thrombosis in the posterior half of the superior sagittal sinus or in a dominant transverse sinus with resultant obstruction to the venous outflow of the brain as a cause of the syndrome. On the basis of such established diagnosis, certain therapeutic aids were found to be useful.

Seven roentgenograms. DANIEL WILNER, M.D.
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Tumor of the Glomus Jugulare with Extension into the Middle Ear. (Nonchromaffin Paraganglioma or Carotid-Body-Type Tumor). Eben Alexander, Jr., Parker R. Beamer, and Jerome O. Williams. J. Neurosurg. **8**: 515–522, September 1951.

The authors report a case of tumor of the glomus jugulare corresponding to tumors reported by others under this designation or as tympanic body tumors or "non-chromaffin paragangliomas." There are small bodies in the adventitia of the dome of the jugular bulb which histologically resemble the carotid bodies at the bifurcations of the common carotid arteries. Some of these bodies are situated along the tympanic branch of the glossopharyngeal nerve, and others below the tympanic cavity. Their blood supply is derived from the external carotid artery; the nerve supply arises from the glossopharyngeal nerve. Similar structures are also found (1) in the ganglion nodosum of the vagus nerve; (2) in the adventitial portions of the ascending aorta, and aortic arch, innominate artery, and probably the pulmonary artery; (3) possibly in the orbit near the ciliary ganglion. It has been suggested that these structures be considered as homologous parts of a system composed of nests of non-chromaffin cells, of "epithelioid" type, situated in a perivascular stroma and resembling the carotid body histologically.

The authors' patient was a 35-year-old Negro woman who complained of deafness in her left ear, tinnitus associated with some ataxia, headaches, a disturbance of phonation, and hiccoughs. There were almost complete peripheral paralysis of the left seventh nerve and complete paralysis of the eighth, ninth, tenth, eleventh, and twelfth cranial nerves on the left. Protruding through the left eardrum was a smooth, red mass with very slight pulsations synchronous with the heart beat.

Roentgenograms showed extensive destruction of the petrous portion of the left temporal bone, with cloudiness of the left mastoid. Left common carotid angiography was performed with 35 per cent Diodrast.

The films showed a normal pattern for the anterior and middle cerebral vessels. In addition, they disclosed a vascular mass filling the floor of the posterior fossa on the left side and extending slightly across the midline. Posteriorly it reached as far as the foramen magnum, and seemed to extend into the middle fossa as well. Biopsy of the mass in the left external auditory meatus established the diagnosis.

The patient was given radiation therapy, receiving 2,080 r through each of two 10 × 10-cm. occipital portals cross-firing the tumor. The total dosage was administered over a nineteen-day period. About six weeks later further roentgen therapy was given, approximately 900 r being delivered through a left occipital portal and 1,200 r through a right occipital portal. A satisfactory follow-up was not obtained, but the family physician reported definite improvement.

Tumors of the glomus jugulare are encountered most frequently in the age group from thirty to fifty years, but they have been found in patients as young as twenty-three and as old as eighty years. Twenty-two of a total of 28 cases reported in the literature have occurred in women. The medical histories are usually of relatively long duration, and in at least 2 cases the patients suffered symptoms for twenty years or more.

Roentgen therapy has not been found to be particularly effective in tumors of this histologic type, occurring in the region of the carotid body, and it is not likely that this tumor will be favorably affected by such treatment. However, a continued trial of irradiation is indicated for the larger tumors invading the petrous portion of the temporal bone and with intracranial extension.

Four roentgenograms; 2 photomicrographs.

HOWARD L. STEINBACH, M.D.
University of California

Bilateral Internal Carotid Aneurysm Involving Cavernous Sinus. Right Carotid Artery-Cavernous Sinus Fistula and Left Saccular Aneurysm. Bernard J. Alpers, N. S. Schlezinger, and I. M. Tassman. Arch. Ophth. **46:** 403–407, October 1951.

Bilateral aneurysms involving the internal carotid artery in the cavernous sinus are rare and present difficulties in diagnosis and treatment. Among 75 verified aneurysms, only a single instance of aneurysm of this type has been encountered.

The authors' case is that of a woman, aged forty-five, in whom a bilateral cavernous-sinus aneurysm developed against a background of premenstrual headache extending over a number of years. She was known to have hypertension, and about eleven months before the onset of her illness she had weakness of the left arm, lasting about two months. Two or three years previously she had experienced a noise in her head, which persisted until six weeks before her present trouble. About five weeks before admission to the hospital she had severe headache and complete ophthalmoplegia on the left side, followed in thirty days by headache and ophthalmoplegia on the right side. Examination showed bilateral exophthalmos, greater on the right, with complete ophthalmoplegia bilaterally. A loud bruit was heard over the right side of the face and head. Arteriographic studies revealed a carotid artery-cavernous sinus fistula on the right side and a saccular aneurysm on the left. During the course of her hospital stay, the patient recovered partial use of the right eye. Six weeks after her discharge, examination showed a complete return of movement of the right eyeball except for residual paralysis of the external rectus. The ophthalmoplegia on the left side remained unchanged. The bruit was still heard over the entire head but was loudest on the right side.

Three roentgenograms; 4 photographs.

Elongated Styloid Process Which Interfered with Function of a Singer's Voice. Operation and Recovery. Otto V. M. Schmidt. Arch. Otolaryng. **54:** 417–421, October 1951.

The styloid process is formed from the union in adult life of the tympanohyal and the stylohyal parts of the hyoid arch cartilage. The average process is 2.5 cm. in length; it springs from the petrous portion of the temporal bone just in front of the stylomastoid foramen and extends downward, forward, and inward.

A case of elongation of the styloid process in a 27-year-old male singer is reported. The chief complaints were inability to sustain top notes and fatigue on using the throat muscles, lumps in the throat, and difficulty in closing off the nasopharynx. The larynx and sinuses were normal; the tips of both styloid processes could be easily felt in the throat. At operation, the styloid process itself was not shortened but a piece from the styloid ligament, which had calcified, was excised. A good result was attained.

It is difficult to distinguish between the ossified ligament and the styloid process except when the location of the joint between the two is demonstrated roentgenographically.

Two roentgenograms; 4 photographs.

THE CHEST

Aqueous Contrast Media in Bronchography. Charles M. Morris and Herbert M. Stauffer. Ann. Otol., Rhin. & Laryng. **60:** 802–816, September 1951.

The authors give the formulae of the two aqueous preparations recently advocated for bronchography, Umbradil Viscous B (Morales and Heiwinkel: Acta radiol. **30:** 257, 1948. Abst. in Radiology **53:** 303, 1949) and Ioduron B (Fischer: Schweiz. med. Wchnschr. **78:** 1025, 1948. Abst. in Radiology **53:** 440, 1949). In their essential constituents, these two media are identical. The viscosity of Ioduron B, however, is much greater than that of Umbradil Viscous B. Bronchograms obtained following instillation of Umbradil accordingly are more likely to show peripheral and alveolar filling, and will show mucosal coating rather than bronchial filling.

It would appear that no one viscosity will be suitable for all cases. In fact, one of the advantages of the aqueous media lies in the ease with which their viscosity may be regulated over a wide range. This may be accomplished by adding carboxymethyl cellulose to Umbradil, but the same result may be accomplished more easily by adding an aqueous solution of Iodopyracet (such as Diodrast, 70 per cent) to Ioduron B. This decreases the concentration of the viscosifying agent and slightly increases the concentration of the contrast substance.

In principle, the technic of instillation is identical with that described by Jackson and Bonnier for bronchography in 1937 (Ann. Otol., Rhin. & Laryng. **46:** 771, 1937). If the entire lung is to be demon-

strated, the upper lobe is ordinarily filled first, under fluoroscopic observation. Then, as the fluoroscopic table is elevated, suitable postures to favor filling of the lower portions of the bronchial tree are employed. Routine films should include both lateral and posteroanterior projections, the latter preferably stereoscopic. If the left side has been filled, the right anterior oblique projection is of particular value in demonstrating the lingula. On completion of the procedure, the patient is encouraged to cough out as much of the instilled material as possible.

Of the advantages offered by the aqueous preparations, undoubtedly the most important is their rapid absorption. This property is of particular value in the bronchographic investigation of obscure pulmonary disease, when serial roentgen studies are indicated, and in the localization of foreign bodies, when subsequent fluoroscopic aid will be required for bronchoscopic removal. In other instances, where the initial bronchograms are unsatisfactory due to cough, excessive alveolar filling, or incomplete filling, the procedure may be repeated the following day without interference by residual opaque material.

Chief among the disadvantages is the more exacting technic required for adequate anesthesia. Transient bronchial irritation, with resultant cough, is greater than that following instillation of iodized oil. Roentgen contrast is poorer than with Lipiodol, but only slightly less than with Iodochlorol. In adults with limited pulmonary function, the preparations of higher viscosity cannot be used because of their obstructive effect. Usefulness in infancy and childhood is limited by the risks of local anesthesia, except in those clinics where general anesthesia is employed for bronchography in this age group.

Clinical use of the two preparations described has been considered to involve little risk of toxic reaction. As concerns systemic effect, this is undoubtedly true. Stability of the contrast substance, Iodopyracet, is such that decomposition to yield free iodine does not occur in the lung, gastro-intestinal tract, or blood stream. Advanced renal disease may contraindicate use of Iodopyracet by any route.

Evaluation of changes in human lungs following instillation of the aqueous preparations is confused by the apparently frequent occurrence of granulomatous changes due to end products of lung degeneration liberated in chronic suppurative disease. Furthermore, a lipoid or cholesterol type of pneumonitis, unassociated with bronchial stenosis or bronchiectasis, has been described.

General adoption of aqueous media for routine bronchography will depend on ultimate demonstration that tissue response is of significantly lesser degree than that following instillation of iodized oil. Further studies of surgical and postmortem specimens following bronchography would appear to be the most logical method of investigation.

Twelve bronchograms; 1 photograph; 1 graph.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Bronchography in the Infant and Very Young Child. Fernand G. Eeman. Ann. Otol., Rhin. & Laryng. **60**: 793–801, September 1951.

The author asks: "Why is bronchography seldom performed in children under seven or eight years of age and practically never considered in younger children or infants?" In reply, he quotes Miller, Conyers and Dinhoffer (J. Pediat. **36**: 721, 1950. Abst. in Radiology **56**: 758, 1951): "Bronchography is performed in far fewer cases than is desirable."

The dangers of bronchography are given as follows: (*a*) the risk of the anesthesia, (*b*) the risk of the technical procedure of introduction of the opaque oil, (*c*) the risk of respiratory trouble due to the filling of the tracheobronchial tree, (*d*) the risk of intoxication due to iodine. These are discussed in turn as they apply to children:

(*a*) It has certainly not been proved that children are more sensitive to local anesthetics than adults. Furthermore, anesthesia is not always essential in order to perform satisfactory bronchography in the young child. The transglottic catheter or bronchoscopic methods will often permit one to obtain technically adequate bronchograms without resorting to anesthesia.

(*b*) As to the risk of introduction of the opaque oil, one may assume that a rigid instrument will be more traumatizing for the delicate laryngeal tissues and bronchial mucosa or skeleton of a very young child, especially if the procedure involves bodily mobilization of the patient. The soft catheter introduced either through the nose or directly into the larynx through the mouth is just as inoffensive in children as in adults.

(*c*) The risk of respiratory trouble due to the filling of the tracheobronchial tree with iodized oil is minimized by injecting a reduced amount. In an infant, 1.5 or 2.0 c.c. will often be sufficient. In some young bronchiectatic patients larger amounts of iodized oil can be introduced without danger of overfilling. This is another of the many good reasons why the instillation of the radiopaque oil must be done under fluoroscopic control.

(*d*) The risk of intoxication due to iodine seems to have been overestimated in adults. There is no reason why it should necessarily be greater in young children. Local accidents due to this cause are infrequent. To diminish them still further, a few precautions should be taken: (1) Iodine suspensions should not be used in known cases of acute tuberculosis except when the examination is urgently indicated. (2) Skin tests for sensitivity to iodine should be done two days before a proposed bronchography. (3) Only the necessary amount of lipiodol should be injected. (4) General anesthesia should be avoided, as it slows down the spontaneous expulsion of the oil suspension through coughing and expectoration. (5) This natural expulsion should be quickened either by immediate aspiration or by postural drainage for twenty to thirty minutes.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Bronchography and the Fine Structure of the Lung. Roentgen-Anatomical and Histological Experimental Studies. H. H. Weber. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 259–289, September 1951. (In German)

The object of the study reported here was to investigate the fine structures of the lung in relationship to bronchographic interpretation. The normal anatomy was accepted on the basis of recent standard publications. For the purpose of experimental research, a rather elaborate model was constructed in which the lungs were suspended in an air-tight container, with a pump attached so that the normal respiratory pressures could be simulated. The bronchial tree

was filled with various solutions of different viscosities down to a pure aqueous solution of iodine.

Autopsy material from newborn infants and children dying during the first few days after birth was used. These specimens were appropriate for this type of study, as the passage to the finer bronchioles is much shorter than in the adult and the filling considerably easier. After injection of the various contrast materials, x-ray studies were made and histologic specimens were examined.

The author states that the grape-like shadows seen in the average bronchogram do not represent the alveoli, but a superimposition of the bronchioles and the acinar shadows, and that true alveolar filling is therefore a misnomer. This applies to bronchograms made with all of the more viscid types of solutions, *i.e.:* Lipiodol and the iodine-carboxymethyl-cellulose mixtures. The pure aqueous iodine solution, low viscosity thorium dioxide solutions, and the extremely thin Iodipin and Joduron S demonstrated the alveoli.

The author theorizes that possibly in the future an aqueous contrast solution may be useful in certain types of bronchographic examination, in asthma, emphysema, etc.

Forty-two illustrations, including 30 roentgenograms.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Bronchography in Pulmonary Tuberculosis, with Histopathologic Correlation in 82 Resections. Maurice G. Buckles, William L. Potts, Horace B. Davidson, and Wilford B. Neptune. Am. Rev. Tuberc. **64:** 394–407, October 1951.

In a series of 222 consecutive patients with pulmonary tuberculosis in whom bronchography was done, 115 (51.8 per cent) were found to have evidence of bronchiectasis, and 81 of these later had pulmonary resection (82 resections). No pontocaine reactions of any significance were encountered and no post-bronchography complications were noted with the exception of a single instance of atelectasis which was relieved by bronchoscopy. Correlation of the histopathologic findings and the bronchographic findings was not good, since only 63.7 per cent of patients with bronchographic evidence of bronchiectasis also had histologic evidence of the disease. The reasons advanced for the discrepancy were over-reading of bronchograms, overlooking borderline bronchiectasis in the pathologic specimens, confusion of oil-filled cavities with dilated bronchi, and misinterpretation of distortions due to tuberculous bronchitis.

The authors use the term *tuberculous bronchiectasis* only in cases with extensive destruction of bronchial walls by tuberculosis, and only 2 cases were found with this type of lesion; tuberculous bronchitis with bronchiectasis secondary to obstruction was much more common.

Over one-half or the patients in the study had far advanced pulmonary tuberculosis, about one-third moderately advanced, and the remainder minimal tuberculosis; all had active lesions proved by bacteriologic studies. No anatomic location was found to be significantly susceptible, the ectasia being largely dependent upon the location of the responsible parenchymal disease. Microscopic evidence of tuberculous bronchitis was found four times more frequently than it could be demonstrated on preoperative bronchoscopic examination, and the authors feel that this type of disease is commonly the cause of positive sputum in patients with associated bronchiectasis where the latter is non-tuberculous.

Bronchography is indicated along with bronchoscopy in all cases of pulmonary tuberculosis under consideration for major thoracic surgical procedures, to help in ascertaining the complete extent of pathological involvement, despite the fact that the involvement is often non-tuberculous.

Six roentgenograms; 9 tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Function Tests in Pulmonary Surgery. G. Birath and C. Crafoord. J. Thoracic Surg. **22:** 414–423, October 1951.

Major pulmonary surgery inevitably reduces the respiratory area of the lungs. Preoperative function tests are essential to estimate how much reduction of respiratory area can be borne without crippling the patient. Such estimates prevent over-ambitious procedures, but also encourage beneficial measures in some who would otherwise be denied surgery.

Respiratory function tests include: (*a*) radiologic investigation of movements of the diaphragm and thoracic cage; (*b*) spirometric investigation, including estimation of the total lung volume and its subdivisions and the maximal ventilation capacity; (*c*) bronchospirometry; (*d*) catheterization of the pulmonary artery for determination of pressure at rest and during exercise.

The radiologist should be prepared to report any impairment of diaphragmatic mobility, since ventilation insufficiency dyspnea is most commonly due to decreased diaphragmatic mobility from pleural adhesions. A rough estimate of ventilation capacity on each side can be made by fluoroscopic observations with forced breathing. Registration of maximal diaphragmatic movements may be accomplished by an ordinary double exposure showing the levels at inspiration and expiration, but the authors have found a Birath and Källqvist grid most useful for this purpose. The grid has vertical lead bars 0.5 cm. wide set 0.5 cm. apart. After the first exposure, made at maximal inspiration, the patient and the film remain absolutely stationary, but the grid is shifted 0.5 cm. laterally and maximal expiration is registered on the previously unexposed film. A second double-exposure film is made with the patient in a slightly oblique lateral position (a true lateral does not show both posterior costophrenic sulci as clearly). In this way, a record is obtained of significant pleural adhesions, impaired diaphragmatic function in emphysema, and reduced costal movements in pulmonary retraction and pleural thickening.

Twelve roentgenograms.

DONALD DEF. BAUER, M.D.
St. Paul, Minn.

Roentgenologic Differential Diagnosis of Miliary Lung Lesions. L. Weingärtner. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 194–196, August 1951. (In German)

The roentgenologic diagnosis of miliary tuberculosis in children may occasionally be quite difficult. Yet a correct diagnosis is important because the administration of heavy doses of Streptomycin is not free from danger, and should be undertaken only on strict indica-

tions. The author presents two cases in which the roentgen findings were strongly suggestive of miliary tuberculosis but no tuberculous process was present.

The first patient was a three-year-old child who had whooping cough shortly before admission to the clinic. The x-ray film of the chest was strongly suggestive of miliary tuberculosis. Death occurred before a tuberculin test or other examinations could be carried out. The postmortem examination showed a diffuse bronchitis and bronchiolitis with numerous small bronchopneumonic foci.

The second case was that of a child of four years. Again, the x-ray film of the chest suggested miliary tuberculosis. It was noticed, however, that the distribution of the fine foci was mainly in the mid portions and lower portions of the lungs, and that the apices remained clear. This led to suspicion of another disease. Sternal puncture showed cells suggestive of xanthomatosis, and postmortem examination revealed Niemann-Pick's disease, with involvement of both lungs.

In the differential diagnosis of miliary tuberculosis of the lungs, the following conditions should be kept in mind: bronchial pneumonia, syphilis, miliary carcinosis, Boeck's sarcoid, hyperemic deposits of "heart failure cells," and parasites. The correct diagnosis will often have to be made on clinical grounds. Tuberculin tests, gastric lavage, blood counts, blood pictures, etc., will usually make a diagnosis possible.

Two roentgenograms; 1 photograph.

WM. A. MARSHALL, M.D.
Chicago, Ill.

An Evaluation of the Role of Serial Chest Roentgenograms in Estimating the Progress of Disease in Patients with Pulmonary Tuberculosis. J. Yerushalmy, L. H. Garland, J. T. Harkness, H. C. Hinshaw, E. R. Miller, S. J. Shipman, and H. B. Zwerling. Am. Rev. Tuberc. **64**: 225–248, September 1951.

It has been assumed that it is possible to determine the "activity" of pulmonary tuberculosis by means of a study of serial chest roentgenograms taken at appropriate intervals. In order to determine the validity of the assumption, a study was made of two 14 × 17-inch chest films taken at approximately three-month intervals on 150 patients with pulmonary tuberculosis. Three radiologists and three phthisiologists interpreted the films independently and reinterpreted the same films after a lapse of time. Thus, a total of 12 independent readings on each pair was available for analysis.

A series of trials resulted in the selection of three simple categories: *better, no change,* and *worse;* more elaborate classifications were found to result in very high disagreement. The data obtained are summarized in a series of tables. The main finding is that competent physicians are likely to disagree with each other regarding the activity of disease in nearly one-third of the cases and a single reader is likely to disagree with himself in approximately one-fifth of cases. The findings emphasize the importance of using all available procedures in determining the progress of tuberculous disease. Furthermore, the study indicates that roentgen study should not be limited to two single posteroanterior chest films made a few weeks apart.

[This paper is a companion report to one which appeared in RADIOLOGY (**58**: 161, February 1952), based on the same material but placing greater emphasis on the roentgenographic observations.—Ed.]

Thirteen tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Clinical Importance of Lesions Undetected in a Mass Radiographic Survey of the Chest. Henry B. Zwerling, Earl R. Miller, James T. Harkness, and J. Yerushalmy. Am. Rev. Tuberc. **64**: 249–255, September 1951.

Based on a mass chest roentgenographic survey of 1,807 entering college students, the present study was undertaken to determine the significance of pulmonary lesions which may be overlooked in this type of examination. The material was previously used by Yerushalmy in his investigation of the role of dual readings in mass chest roentgenography (Am. Rev. Tuberc. **61**: 443, 1950. Abst. in Radiology **56**: 291, 1951).

Thirty patients were ultimately thought, on the evidence of 14 × 17-inch films, to have inflammatory disease which warranted further study. Eventually 23 cases in this group were found to be "inactive," while the remaining 7 had "active" lesions, either clinically (3) or bacteriologically (4).

Since a total of ten readings had been obtained on each of the films in the original study, a total of 300 readings were available for the 30 cases. It was found that approximately one-third of the "positive" cases were overlooked and that the "active" cases were missed as often as the "inactives." Although the number of cases is small, the study indicates that the problem of error in mass survey is an important and practical one. This problem can be partially solved by having the survey films read independently by more than one reader.

Two tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Detection of Unsuspected Heart Disease in Photofluorographic Chest Surveys. Arthur Selzer, Marlow B. Harrison, and Gladys Taylor Daniloff. Am. Heart J. **42**: 355–361, September 1951.

Some 155,000 minifilms (35 mm.) taken during a tuberculosis survey were reviewed for the purpose of detecting previously unknown heart disease. In 1,356 (0.87 per cent), abnormal appearing cardiac shadows were considered to be present. Fluoroscopic re-examination of 846 of this latter group confirmed the presence of abnormalities in only 514 cases, indicating the value of fluoroscopy in eliminating many false-positive minifilms, especially those due to technical difficulties.

Clinical studies, by various physicians, of 193 of the patients with abnormal findings confirmed fluoroscopically revealed that 28 (14.5 per cent) had no evidence of heart disease. In 165 (85.5 per cent), a clinical diagnosis of heart disease was made. In 89 of these, heart disease was previously unknown.

The 89 cases of previously unknown heart disease discovered, although important in themselves, represent a disappointingly small yield for a survey of this magnitude. One of the chief objections to such films for cardiac survey is their inaccuracy in the estimation of heart size.

One chart; 4 tables.

HOWARD L. STEINBACH, M.D.
University of California

Clinical Evaluation of the X-Ray Diagnosis in Interstitial Pneumonia of Premature Children. R. Garsche. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 125–138, August 1951. (In German)

In recent years attention has been called to a complex of symptoms best designated "interstitial pneumonia of premature children." The basis of the disease is an edema in the interstitial tissues of the lungs characterized by the presence of many monocytes. Only premature children are affected, particularly those having a birth weight of 1,500 gm. or less. There is a symptom-free period of about nine to thirteen weeks after birth, with the manifestations of the disease invariably occurring in the third or fourth month of extrauterine life.

An initial sign is pallor of the face, sometimes associated with slight cyanosis. There is a marked increase in the rate of respiration, which may reach 120 to 140 per minute. This may appear suddenly, within a few hours, or may develop more slowly within the course of a few days. The children seem to breathe only with the lower portions of the lungs. The upper portions remain quiet, in contradistinction to pneumonia of the usual type, in which the upper portions of the lungs show the characteristic auxiliary respiration. The signs seen in the usual pneumonia of premature children, such as fever, changes in the blood picture, increase in the sedimentation rate, gastrointestinal symptoms, etc., are absent. The temperature for the most part remains normal, and the children gain in weight. There is no disturbance of alimentation or of water metabolism. The physical examination is practically negative. The respiration continues rapid for about two weeks, with certain variations, and then declines either slowly or sometimes more rapidly to normal levels, or the child may die quite suddenly with symptoms of suffocation.

The x-ray findings are important. In the early stages there is usually a veil-like cloudiness involving both upper lobes and the mid portions of both lungs; the lower portions may show some emphysema. Within the veil-like densities of the upper and middle portions of the lungs there may appear areas of atelectasis or of emphysema that give the films as seen in serial roentgenography a rather varied aspect. With clinical recovery, the shadows gradually clear and the chest film assumes a normal appearance. Sometimes, however, secondary complications such as bronchial pneumonia, may occur.

The mortality may reach 60 per cent. Nothing definite is known about the etiology. A virus infection has been mentioned, but clinically all signs of an infection seem to be absent. The disease occurs in some countries of Europe more frequently than in others. In the United States it is practically unknown. The fact that the veil-like densities are always present on the roentgenogram on the first day of the symptoms has led the author to make a routine examination of all premature children before the appearance of symptoms. In some of them these shadows have been observed and disappeared without the clinical manifestations. Apparently the child can compensate for a certain degree of interstitial edema, and only when this threshold is exceeded do symptoms develop. X-ray examination of these children must be done with great caution to avoid loss of heat and to prevent contamination by infection.

[This paper would seem to offer good support for routine x-ray examination of premature children for case finding purposes.—W. A. M.]

Fifteen roentgenograms; 1 photograph; 1 chart.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Salmonella Senftenberg Pneumonia: Report of a Case. Arthur Bernstein and Lawrence Perlman. Ann. Int. Med. **35:** 721–727, September 1951.

The authors report what they believe is the first case of pneumonia due to *Salmonella senftenberg* to appear in the literature. The diagnosis of pneumonia was established clinically and roentgenographically. Demonstration of *Salmonella senftenberg* in the sputum first directed attention to this organism as the causative factor. Stool cultures and agglutination tests were also positive for *Salmonella*.

Three roentgenograms.

Terminal Bronchiolar or "Alveolar Cell" Cancer of the Lung. William L. Watson and Robert R. Smith. J. A. M. A. **147:** 7–13, Sept. 1, 1951.

Along with the increase in the incidence of carcinoma of the lung in general in the past several years, there has been noted, also, an increase in the "alveolar-cell" type. Since some earlier cases were probably incorrectly diagnosed as metastatic carcinoma, mesothelioma, anaplastic carcinoma, etc., the actual increase cannot be measured. It is of interest, however, that of the 33 cases seen in two decades, 13 were recorded in the last year.

In many ways this type of lung cancer differs from bronchogenic carcinoma. It varies in its rate of growth; some patients live only a few months while others survive for five years or longer. Smoking did not appear to be an etiologic factor in this series, since only 10 of the 33 patients were heavy smokers and 5 did not smoke at all.

Pain and cough were unusual, with occasional bloody sputum. [The authors do not comment on the quantity or frothiness of the sputum reported by others.] The usual x-ray finding was a peripheral nodule. Multiple nodules were present in 7 cases, and the disease was occasionally bilateral. No fibrosis or atelectasis was seen.

Papanicolaou studies of sputum and bronchial washings were positive or strongly suggestive for cancer in 12 out of 15 cases in which they were done. On the other hand, in only 3 of the 19 cases in which bronchoscopy was done was the tumor seen and a biopsy obtained. In all of these the disease was advanced.

In 9 cases treated by irradiation, no appreciable benefit was seen. Surgery was done on 33, and 87 per cent had resectable lesions. Two patients were living more than five years after surgery; 10 others were alive at the time of the report, less than five years.

Pathologically, 70 per cent of this series of patients had a nodular form of lesion and 30 per cent had diffuse tumors. Microscopically these were identical.

The literature covering the controversies regarding the relationship of alveolar-cell cancer and jaagsiekte and whether or not there is a continuous epithelial lining of the alveoli is briefly reviewed.

[A greater number of these cases will be coming to surgery as radiologists and surgeons more fully appreciate the importance of "coin" lesions on chest films of symptomless individuals—Z. F. E.]

Three roentgenograms; 2 photographs; 5 photomicrographs; 1 table summarizing the data for the 33 cases.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Diffuse Pulmonary Lymphatic Carcinomatosis Due to a Renal Carcinoma Showing Cytoplasmic Inclusions. Charles F. Ross. Brit. J. Urol. **23:** 263–266, September 1951.

A case of diffuse pulmonary lymphatic carcinomatosis due to a renal carcinoma is reported. A man of forty-six was admitted to the hospital with a history of severe cough of five months duration, accompanied by expectoration of large amounts of yellow, inoffensive sputum and, more recently, by shortness of breath and febrile attacks but no hemoptysis. Except for generalized râles and crepitations in the chest, physical examination showed no abnormalities. A roentgenogram of the chest was reported as follows: "Woolly nodulo-striate shadow of irregular size superimposed on a finely reticulate shadowing is present generally in all the lung zones, becoming confluent in the right upper and lower zones. The hilar shadows are rather obscured, but do not show a definite glandular enlargement, though this might be present. Radio-diagnosis is debatable. Tuberculosis as the primary cause is unlikely but may be superadded. A dust disease could produce almost exactly this picture, and the absence of basal emphysema does not exclude it. If these two conditions can be excluded, sarcoidosis appears to be the only remaining diagnosis."

In the differential diagnosis were considered (1) silicosis plus tuberculosis, (2) sarcoidosis, (3) mycosis, and (4) carcinomatosis. Treatment was symptomatic and the patient was discharged from the hospital. He died six weeks later.

At autopsy a carcinoma of the right kidney was found. Histologically, the growth showed peculiar "inclusion bodies" in the cytoplasm, which were probably products of abnormal metabolism. There was no evidence of metastasis to the skeleton. Mediastinal, parabronchial, celiac, para-aortic and mesenteric lymph nodes were almost completely replaced by tissue having characteristics similar to those of the primary tumor. Large masses of growth replaced lung tissue.

This case illustrates what diagnostic difficulties may be experienced in cases of renal cancer without urinary symptoms. It was unusual in showing a predominantly lymphatic spread, with particularly massive involvement of the lungs.

One roentgenogram; 1 photomicrograph.

Unusual Case of Bronchiogenic Lung Cyst Simulating Dextrocardia. Forrest H. Adams. J. Pediat. **39:** 483–485, October 1951.

The author reports the case of a 10-week-old girl with cyanosis since birth, thought at first to be due to dextrocardia and atelectasis but later found to be caused by a bronchogenic cyst.

The child did not appear cyanotic while at rest, but became so on crying. Respirations were grunting, rapid (50 to 60 per minute), and labored. Suprasternal, subcostal, and intercostal retraction accompanied each inspiration. Occasional expiratory squeaks were heard on auscultation. The heart was on the right side; no murmurs were audible. An electrocardiogram was normal.

Fluoroscopic and x-ray examination showed displacement of the heart into the right chest, overexpansion of the left lung with evidence of herniation across the midline anteriorly, and consolidation of the right upper lobe, suggesting the possibility of some compressive mechanism such as a vascular ring or an anomaly of the tracheobronchial tree. These latter conditions seemed a much more plausible explanation for the patient's symptoms than dextrocardia, in view of the absence of a heart murmur and the normal electrocardiogram. Esophagrams disclosed no evidence of a vascular ring producing compression upon the esophagus and trachea. On the third attempt at bronchography, satisfactory filling of the bronchial tree was obtained. This showed a cystic cavity about 1.4 cm. in diameter communicating with the bronchus in the region of the carina. Removal of the cyst was followed by complete disappearance of symptoms.

Six roentgenograms.

Pulmonary Hydatid Disease in Man. Ettore de Bernardi. Acta radiol. **36:** 234–240, September 1951.

This is a report on pulmonary hydatid disease in man based on the author's observations, with roentgenograms of 8 illustrative cases. Pulmonary hydatid disease may be diagnosed from the characteristic shape and outline of the cyst. In the early case, the differential diagnosis between hydatid cyst, lung abscess, benign and malignant tumors must be considered. As the cyst ages, the membranes begin to break down, allowing the contents to empty into the pleural cavity or bronchus. The cyst then takes the form of a cavity containing air and the pathognomonic signs of "disjoined membrane," floating membrane, or cystic offshoots above the surface of the cystic fluid, may appear. The death of a cyst is indicated by the appearance of a chalky membrane, a sign seldom encountered.

Nine roentgenograms.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Cysticercosis of the Lungs and Liver. G. Zur. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 186–193, August 1951. (In German)

The author reviews the literature on cysticercosis of the lung, describes a case of his own, and discusses the differential diagnosis. In man the Cysticercus develops mostly in the brain, in the lungs, in the liver, and in the muscles. Sometimes it develops in the eyes and can be seen with the ophthalmoscope. In the lungs the cysts calcify and are then readily detectable on the x-ray film, measuring from 3 to about 6 mm. in diameter. Usually they show a calcareous outer shell and a somewhat lighter, softer center. In the liver the calcareous foci may become much larger, reaching the size of a cherry. The presence of these characteristic calcifications in the lungs as well as in the liver is suggestive of cysticercosis.

In the differential diagnosis of the pulmonary lesions, tuberculosis has to be considered, and differentiation may be difficult if the lung findings alone are observed. Histoplasmosis will not produce calcified foci in the liver. Toxoplasmosis will not produce calcifications in the lungs, but only in the brain. Echinococcosis may present a similar pulmonary picture but the lesions are for the most part near the pleura and a definite diagnosis can be made by the antigen reaction. Silicosis is usually manifest by much smaller calcifications,

while the fibrotic changes make the diagnosis relatively easy. Trichinosis does not commonly occur in the lungs.

In the author's case of cysticercosis definite microscopic proof could not be obtained, but the combination of a known infection with *Taenia solium* and the characteristic calcified lesions within the lungs as well as in the liver make the diagnosis highly probable.

Eight roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Pulmonary Changes Related to Cardiospasm. Richard A. Lake. Ann. Int. Med. **35**: 593–599, September 1951.

Aspiration of esophageal overflow has long been recognized as a source of certain types of pulmonary disease, usually secondary to such causes as esophageal neoplasm, caustic stricture of the esophagus, pulsion diverticulum, esophageal encroachment by extrinsic tumors, foreign body in the esophagus, and postoperative emesis. Chronic or recurrent pulmonary disease of unknown origin, however, is infrequently associated with the well recognized clinical entity of cardiospasm.

Types of pulmonary change described as complicating cardiospasm include basilar pneumonitis, lung abscess, bronchiectasis, pleural effusion, atelectasis, and interstitial pulmonary fibrosis. These changes often prove to be reversible in proportion to the success attained in eliminating the coexisting cardiospasm. Pulmonary changes in roentgenologically proved cases of cardiospasm frequently develop insidiously, unheralded by clinical symptoms of sufficient magnitude to explain them adequately. Conversely, significantly severe and recurrent pulmonary symptoms may occasionally play a characteristic part in the course of cardiospasm without the development of any recognizable pulmonary roentgen changes.

In a survey of 124 roentgenologically proved cases of cardiospasm taken from the University Hospital records, University of Michigan, covering a period of more than five and one-half years, 12 showed signs and symptoms of pulmonary involvement with or without pertinent roentgen findings.

The ages of these patients (5 of whom were female) ranged from ten to sixty-five years. Each case displayed two or more of the characteristic symptoms of cardiospasm (such as dysphagia, ease of satiation, regurgitation or emesis, epigastric pain or burning, and weight loss). All but one patient had pulmonary symptoms significantly related to exacerbations of the cardiospasm. Roentgen evidence of various types of pulmonary involvement was noted in only 5 of the 12 cases. These included bronchiectasis, pneumonia, atelectasis, lung abscess, and pleural effusion.

Fifty per cent of the histories in this series recorded clear-cut evidence of correlated psychiatric problems, which frequently are predisposing factors in the development and persistence of cardiospasm. Several patients could themselves identify the correlation between emotional upsets, return of cardiospasm symptoms, and subsequent pulmonary symptoms.

Three interesting and representative case histories follow to document this chronologic development of events that often leads to serious pulmonary disease.

Well established instances of cardiospasm with no definite history of pulmonary symptoms may present roentgen evidence of chronic lung disease. This is probably the result of many subclinical episodes following aspiration of esophageal contents.

Two roentgenograms; 2 tables.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Pulmonary Complications of Cardiospasm. Arnold S. Breakey, Charles T. Dotter, and Israel Steinberg. New England J. Med. **245**: 441–447, Sept. 20, 1951.

Massive or repeated aspiration of the contents of a dilated, food-filled esophagus, due to cardiospasm, frequently causes significant pulmonary complications, ranging from lung abscess to pulmonary fibrosis. The prompt recognition and treatment of the underlying cardiospasm prevents serious pulmonary disease.

Seventeen new cases of pulmonary complications due to cardiospasm are reported, bringing the total in the literature to 63. In 39.5 per cent of this complete series, the initial presenting complaints were referable to the pulmonary complications, rather than to the esophageal disease. Cough, sputum, hemoptysis, fever, and chest pain were common. Symptoms referable to cardiospasm were either absent or subordinate to the respiratory symptoms. In the other cases, dysphagia, regurgitation, and vomiting were initial complaints. In all of the authors' 17 cases chest roentgenograms established the presence of pulmonary disease.

The aspiration of material from the dilated, food-filled esophagus, especially at night, may cause serious pulmonary disease, and even sudden asphyxia. These lesions cannot be expected to respond to therapy unless attention is directed toward the elimination of the fundamental condition, the cardiospasm itself. The esophagus should be examined when pneumonia, nonspecific pulmonary infiltration, lung abscess, or pulmonary lesions of obscure etiology occur.

Five roentgenograms; 3 tables.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N.Y.

Mediastinal Emphysema Occurring with Therapeutic Pneumoperitoneum: Report of Ten Cases. Milton N. Towbin. Ann. Int. Med. **35**: 555–592, September 1951.

Mediastinal emphysema may be found as a complication in a great variety of conditions. Its occurrence in association with induced pneumoperitoneum is unusual. The author found references to only 15 cases. He had himself seen 10 examples in a period of fourteen months, which he reports.

Mediastinal air may originate from sources located either above or below the diaphragm. For the pathogenesis of mediastinal emphysema secondary to gas from below the diaphragm there are several explanations. Gas is produced in the intestinal tract either by the fermentation of food undergoing chemical decomposition or by gas-forming organisms. Following injury to the intestinal wall, this gas may escape into the surrounding cutaneous tissues with resultant emphysema. As to the route of diffusion of the gas, there appears to be no general agreement. McCorkle and Stevenson (Surgery **2**: 930, 1937. Abst. in Radiology **31**: 124, 1938) believe that diffusion through the parietal peritoneum is feasible only when this membrane is damaged by inflammation and pneumoperitoneum is extensive and under pressure. According to Banyai and Jurgens (J. Thoracic Surg. **8**: 329, 1939), sudden in-

crease in the intraperitoneal pressure in the subdiaphragmatic area allows injected air to escape from the abdominal cavity and reach the mediastinum either by spreading along the large structures which pass through the diaphragm, or by seeping through a traumatized diaphragm.

Another problem, in addition to ascertaining how the peritoneal air escapes, is determining the route taken by the released air to reach the mediastinum. Most writers agree that the free air accompanies the aorta and esophagus, as these structures pass through the diaphragm. To accomplish this, the air must first occupy the retroperitoneal tissues, but the path by which it arrives there remains conjectural.

Any condition characterized by pain in the chest, principally angina pectoris, myocardial infarction, pericarditis, pleuritis, pleurodynia, dissecting aneurysm, pulmonary embolus, spontaneous pneumothorax, broken rib, mediastinitis, or rupture of an abdominal viscus, should be considered in the differential diagnosis of mediastinal emphysema.

Roentgenographic studies are invaluable aids in establishing the presence of mediastinal emphysema. An area of increased lucency is sharply delineated by a distinct white line which runs parallel to one or both borders of the heart. This line represents the outer edge of the mediastinum as the lung is pushed out from behind the cardiac shadow. In the cervical tissues and other soft tissues, subcutaneous emphysema appears as "streaks" of increased radiolucency in the fascial planes.

In 2 of the author's 10 patients, mediastinal emphysema probably resulted from conditions present in the chest. In the remaining 8 instances, both the method by which the gas escaped from a closed peritoneal space and the route it took to reach the mediastinum were obscure.

The author has furnished an excellent and comprehensive analysis of the problem of mediastinal emphysema, with a thorough review of the literature. He appends a bibliography of 200 references.

Five roentgenograms; 3 drawings; 1 table.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Tuberculomas of the Mediastinum. Clifford F. Storey and Harold A. Lyons. Am. Rev. Tuberc. **64:** 327–352, October 1951.

The authors present 6 cases of mediastinal tuberculoma, 5 of which were proved at operation. These tuberculomas all presented as mediastinal masses and were chronic granulomas with no microscopic difference between the lesions and those caused by *M. tuberculosis*. The authors feel that the pathogenesis is relatively unimportant and that the lesions either represent true encapsulated tuberculous abscesses or huge solitary tuberculous lymph nodes in which the normal architecture has been destroyed.

The cases were studied by means of roentgenograms in various positions, fluoroscopy, planigraphy, and angiocardiography. Five of the tuberculomas were in the right upper mediastinum just above the junction of the azygos and superior vena cava and slightly anterior to the midplane of the chest so that they were resting on the anterolateral tracheal wall. All presented as sizable masses and were not at all like the usual calcified tuberculous nodes. Routine roentgenograms were the greatest single diagnostic aid, while planigrams helped detect the presence of calcium, and angiocardiograms excluded vascular lesions.

As a result of the study of the present cases plus a review of 8 others previously reported, the authors feel that a mass in the location described, round or oval in shape and smooth in contour, with a homogeneous density or containing small amounts of calcium, is very likely to be a tuberculous granuloma and that this should be the first consideration in differential diagnosis. Additional findings of a positive tuberculin reaction, a history of tuberculosis, or the presence of the disease elsewhere would strengthen the probability. It must be concluded, however, that an accurate diagnosis can be established only after operation. For this reason, thoracotomy is advised in all such cases, with removal of the mass if this can be done with reasonable safety.

Twenty-one roentgenograms; 5 photomicrographs; 1 drawing.

JOHN H. JUHL, M.D.
University of Wisconsin

Primary Liposarcoma of the Mediastinum. M. C. Kozonis, R. F. Wiggers, and H. M. Golden. Ann. Int. Med. **35:** 703–710, September 1951.

Approximately 200 cases of liposarcoma have been reported, the great majority occurring superficially. To date, the literature in the English language contains reports of only 4 cases of liposarcoma originating in the mediastinum.

Liposarcomas may occur at any age. While congenital cases have been reported, the patients are usually of middle age, and both sexes are equally affected. The tumors are usually single, but multiple liposarcomas have been described. Because they are encapsulated, the tumors do not appear malignant, but after shelling out they will invariably recur locally. Local recurrences may occur a number of times before a fatal metastasis develops. The most common sites for metastases are the central nervous system, lungs, and liver. Pain is seldom a prominent symptom and, when present, is usually due to pressure or hemorrhage. It has been estimated that the average duration of symptoms, from the first complaint until metastases are known to be present, is ten years.

All neoplasms of the mediastinum, even though benign, are a threat to life. They have the inherent potentiality of becoming malignant and, due to the limited size of the mediastinum, have little space for growth without encroaching upon or invading vital structures. In the case recorded here, the superior vena cava and azygos vein were not only compressed, but were also invaded. The tumor apparently grew within the superior vena cava to the heart and extended directly into the right auricle. Invasion of this structure has not previously been attributed to liposarcoma. Autopsy showed metastases also in the lungs, liver, kidneys, lymph nodes and subcutaneous, retroperitoneal and retropleural tissues.

The comparative well-being of the patient until the terminal stage of his illness, in view of the extensive metastases observed at necropsy, is worth noting. This is most characteristic of liposarcoma as opposed to other malignant neoplasms of the mediastinum.

The radiosensitivity of liposarcoma is a matter of dispute. In the case described, clinical improvement and disappearance of the superior vena cava obstruction followed deep roentgen therapy. At necropsy, the superior vena cava appeared to have been recanal-

ized through neoplastic tissue. The occurrence of subcutaneous metastases secondary to primary mediastinal liposarcoma is also unusual. To the author's knowledge, this is the only such case cited in the literature.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Liposarcoma of the Mediastinum. Report of a Case with Associated Lipomas of the Mediastinum and Subcutaneous Tissues. Clifford F. Storey and Kenneth P. Knutson. J. Thoracic Surg. **22**: 300–315, September 1951.

The authors report what they believe to be the sixth recorded case of solitary mediastinal liposarcoma and the first instance of the concomitant occurrence of mediastinal lipoma and liposarcoma.

The subject was an active 55-year-old man with essentially no complaints. He was admitted to the hospital because of the discovery, on a routine chest film, of a large ovoid mass projecting to the right from the superior mediastinum. Additional films showed this to be of homogeneous density, measuring 14 × 8.5 × 7 cm., extending from the right hilus to the thoracic inlet. The mass occupied the upper posterior and mid-mediastinal area. It was regular in outline and sharply demarcated. "Its density was perhaps slightly less than one might anticipate from a mass its size." The mediastinum was not displaced. A photoroentgenogram of the previous year showed a small, clearly visible, right paratracheal superior mediastinal tumor which had been overlooked on the original reading. A tenfold increase in size had occurred during the interval of one year between the two roentgenographic studies.

Fluoroscopic study showed no pulsations or change in contour with respiration. Angiocardiography proved that the mass was not a vascular lesion and that it produced no serious compression of the great vessels. Furthermore, it was proved to be extrapulmonary. Bronchoscopy showed marked compression of the lower trachea and right main stem bronchus but no mucosal lesion. In addition to the chest tumor a somewhat irregularly shaped mass, approximately 8 × 4 × 3 cm., could be seen and felt beneath the skin in the left lower abdominal quadrant. The physical findings were entirely consistent with those commonly exhibited by a lipoma.

On thoracotomy 2 tumor masses were discovered and removed surgically from the right superior mediastinum. The larger mass was a malignant neoplasm characterized by interlacing strands of spindle cells. In some areas, a fibrosarcoma was suggested. Elsewhere a liposarcoma was indicated by the presence of adult fat cells, less differentiated fat-staining cells, and large bizarre cells with spider nuclei. The smaller tumor was an ordinary lipoma.

The treatment of choice for mediastinal liposarcoma appears to be surgical removal whenever possible. Some liposarcomas, however, have proved to be radiosensitive and for that reason irradiation should not be entirely abandoned. The prognosis is poorly established. The well differentiated liposarcoma has a favorable outlook but there may be local recurrence long after removal. Metastases are the rule in the poorly differentiated lesions.

Six roentgenograms; 4 photomicrographs; 3 photographs; 1 table. DONALD DEF. BAUER, M.D.
St. Paul, Minn.

Intrathoracic Goiter: Surgical Management and Roentgenographic Appearance. Robert D. O'Malley, William Barclay Parsons, and Robert P. Ball. Surg., Gynec. & Obst. **93**: 197–208, August 1951.

The authors present eight selected cases of intrathoracic goiter mainly to show the delay in recession in size of the mediastinum following their surgical removal. Only rarely did they find it necessary to split the sternum to remove the tumor from the mediastinum. After removal of the goiter they prefer to drain the majority of the cases for a few days. When the gland is small, drainage is omitted.

Serial radiographic studies have shown that the superior mediastinum remains widened for some time after the removal of a tumor, six to twelve weeks being usually required for restoration to normal. This postoperative widening of the upper mediastinum appears to be due in part to the presence of edema and possibly slight hemorrhage. Edema alone, however, would not be likely to persist more than two weeks. It is probable that the final molding effect to produce a normal silhouette is dependent upon the positive pressure exerted by the expanded lungs.

Thirty-three roentgenograms.

FRANCISCO CAMPOY, M.D.
University of Pennsylvania

Regarding Rupture of the Bronchial Lymph Nodes. H. Behrendt. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 318–322, September 1951. (In German)

Recognition of spread of infection by perforation, rupture, or fistulous formation of the bronchial lymph nodes is an important observation in clinical management. Such a diagnosis may be made bronchoscopically, by observation of the clinical symptoms and course of the condition, and by the x-ray appearance. Clinically, there may be increased cough with expectoration, fairly acute in onset, and sometimes expectoration of caseous material or blood. X-ray appearance of cavitation within the node-bearing area, increased density segmentally, and new areas of involvement, especially in the adjacent lung lobe, are very suggestive of a spread of infection from ruptured nodes.

As these areas heal, fibrosis and calcium deposits form as in tuberculous areas elsewhere. Areas of cavitation and atelectasis are often present within these regions, and occasionally the material is aspirated, forming new foci in other lobes. Tomography and bronchography may be helpful in locating small cavity formations and demonstrating associated atelectasis and bronchiectasis.

The author expresses the opinion that rupture of the bronchial lymph nodes occurs frequently without being definitely diagnosed, and he is inclined to feel that the resulting processes are frequently more benign than has been considered in the past. No satisfactory method of treatment has been decided upon.

Nine roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Bronchobiliary Fistula in Hodgkin's Disease. S. Trubowitz. Arch. Int. Med. **88**: 400–405, September 1951.

Bronchobiliary fistula is usually a complication of parasitic disease of the liver. According to Morton and Phillips (Arch. Surg. **16**: 697, 1928), a prerequisite

for the formation of such a fistula is obliteration of all potential space between the liver and diaphragm and the diaphragm and lung. The abscess in the liver communicates with the lung by a firm-walled tract.

The outstanding clinical feature is the continued expectoration of bile. Fever, right upper quadrant tenderness, and a hacking cough are usually present. The cardinal roentgen signs (Flynn and Warren: Am. J. Roentgenol. **20:** 364, 1928) are a fixed high right diaphragm and an abscess near the diaphragm and involving the liver. In the case reported here the first of these signs was present, and a radiotranslucent area was demonstrated bronchographically below the diaphragm, possibly representing the fistulous tract. The patient was suffering from Hodgkin's disease, and the fistula is attributed to Hodgkin's involvement of the liver. The author believes this is the first report of bronchobiliary fistula due to this cause.

Four roentgenograms. SAM FINCK, M.D.
Mt. Sinai Hospital of Cleveland

Clinical Significance of Pleuropericardial Cyst. Karl Morgan Lippert, Henry Potozky, and Irvine K. Furman. Arch. Int. Med. **88:** 378–386, September 1951.

Pleuropericardial (pleurocelomic) cysts typically occupy the right cardiophrenic angle. They are thin-walled, endothelial-lined sacs containing clear fluid of low specific gravity. Their chief significance lies in the necessity of differentiating them from pathologically important lesions, especially dermoid cysts.

The etiology of pleuropericardial cysts is poorly understood. It is possible that they are due to failure of one of the primitive lacunae to merge with the others in the embryological development of the pericardium.

The differential diagnosis is best made by roentgenologic examination, with the aid of pneumothorax, pneumoperitoneum, bronchography, and angiocardiography where needed. When a differential diagnosis cannot be made, thoracotomy should be done.

Three surgically proved pleuropericardial cysts are reported.

Nine roentgenograms; 1 photograph.

SAM FINCK, M.D.
Mt. Sinai Hospital of Cleveland

Heart Shape and Body Build. R. W. Morris and L. M. Jacobs. Lancet **2:** 666–668, Oct. 13, 1951.

A good deal of work has been done on the relation between external shape and the configuration of the viscera, but most of the investigators have used classifications of physique which are no longer considered adequate. Some sliding scale, such as that of Sheldon *et al.* (The Varieties of Human Physique, New York, Harper & Bros., 1940) or Tanner (Lancet **1:** 405, 1949; **2:** 574, 1951) should be adopted. From various studies it appears that those diseases that are common in modern civilized society are related in some way to body build. The present study was undertaken to determine if any basic cardiac pattern for each somatotype could be demonstrated.

A total of 109 male students, eighteen to twenty-eight years of age, were examined. Each was somatotyped by photographic anthroposcopy, and standardized radiologic studies were carried out on all but 9. In the predominantly ectomorphic individual, the heart clears the low diaphragm easily, but in predominant mesomorphs and endomorphs the heart fails to clear the high diaphragm. To determine whether the differences observed were true or illusory, further studies were made.

Effect of rotation: Simulated rotation of the heart on its longitudinal axis failed to alter the cardiac contour significantly. It was also found impossible to change the heart's shape by tilting the subject 45° backward, laying him prone, or even tilting him with his head down at 45°.

Effects of cardiac cycle on heart configuration: Ten films were taken at random intervals in mid-inspiration. The transverse diameter varied between 114.0 mm. and 125.5 mm., and the broad and long diameters to a similar degree, yet the contours of the heart remained basically unaltered.

The *effects of respiration* were studied on 3 individuals, respectively high in endomorphy, mesomorphy, and ectomorphy. Roentgenograms were made in full inspiration, mid inspiration, and full expiration. The tent shape and prominent right auricle of the endomorph were found to persist, and the squatness is only slightly overcome by deep inspiration. The heart of the mesomorph becomes more squat during full expiration, but the somewhat angular lower border of the ventricle remains. In inspiration the heart is slender and tends toward a mixture of the tent-shaped and square types. However, the distinctly angular contours are well seen (right auricle) and the heart remains massive. The diaphragm is not well cleared. The heart of the ectomorph is linear in inspiration. The contours are smooth and the diaphragm is well cleared. The heart is shorter and more squat on expiration. Though the transverse diameter increases, there is little tendency for the heart to become tent-shaped, for both halves of the diaphragm are still well cleared, and distinct angles appear between them and the heart shadow.

The length of the heart was measured on each posteroanterior teleradiogram, from the junction of the aorta and superior mediastinal or sternal shadow to the point of meeting of the right heart and right half of the diaphragm.

The index of linearity—*i.e.*, body height (cm.) divided by length of heart (cm.)—the transverse diameter, and heart shape were plotted in one graph. Where the index is high and the transverse diameter great, the heart is of the short, squat, tent-shaped variety commonly found in endomorphic individuals. Conversely, a low index and small transverse diameter produce the linear heart found in ectomorphs. The square, rugged hearts of the mesomorphs lie between the two extremes. In 92 per cent of cases the shape of the heart could be correlated with the somatotype of chest, abdomen, or body as a whole. In 8 men the heart appeared to be in the wrong body. The underlying cause for this may be dysplasia, which indicates a lack of harmony between the somatotypes of the five regions of the body.

Nine roentgenograms; 1 graph; 2 tables.

A Study of the Value of the Roentgenologic Demonstration of Valvular Calcifications. P. D. Genovese and R. T. Levin. Am. Heart J. **42:** 344–354, September 1951.

The authors, working in a Veterans Administration Hospital, looked for valvular calcifications in every patient admitted with heart disease. An effort was made to evaluate the diagnostic and prognostic sig-

nificance of such calcifications. Seventy-five male patients were included in the study, the average age being 50.2 years. There were 50 patients with a diagnosis of rheumatic mitral valvular disease and 48 with a diagnosis of rheumatic aortic valvular disease, the combined diagnosis being made in 23 instances. The roentgenologic examination consisted of fluoroscopy followed by roentgenograms.

Calcifications in the aortic valves were found in 21 patients, in the mitral valves in 15, and in both valves in 3. During the period of study, postmortem examinations disclosed 5 cases of aortic valve calcifications which had not been found roentgenologically. In 3 of these cases fluoroscopy had not been done, and in 2 the examination was unsatisfactory because of pulmonary disease.

There was no correlation between the presence of calcification in the aortic valve and the severity of the disease. In calcification of the mitral valve, on the other hand, such a correlation was observed. Few patients with this condition survived more than a year.

Six roentgenograms; 1 table.

HOWARD L. STEINBACH, M.D.
University of California

Heart Changes in Silicosis (Comparison of X-ray Studies of Silicosis in Various Dusty Occupations). R. Haubrich. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 303–317, September 1951. (In German)

After discussion of the known anatomical and pathological phases of silicosis, the author stresses the importance of careful fluoroscopic observation, kymography, and the correlation of the x-ray findings with the electrocardiographic data.

Left heart enlargement with elongation of the long axis is frequently found in fairly early and moderately advanced cases. This is in part due to exertion hypertrophy and is especially noted in stone cutters and polishers, fireproof stone workers, and miners. Left heart enlargement is often apparent with right ventricular hypertrophy or dilatation. In persons heavily exposed to dust, the typical "small heart" is observed. This is due to rotation and fibrotic change, and is most notable in the fireproof stone workers, who have marked lung changes and definite prominence of the long axis of the heart. Generally, in the moderately severe case, there is preponderance of the right heart. Auricular enlargement may be evident before enlargement of the ventricles because of the thinner musculature. No single configuration is typical, there being a balance of factors, prominence of the pulmonary artery segment contributing to the bulging of the left border as well as the left ventricular and right ventricular enlargement. In the early and moderate stages, therefore, the x-ray appearance may be that of either left- or right-sided prominence because of the above factors. In the very late stages right heart prominence is more frequently seen.

Electrocardiographic findings demonstrate associated muscle damage as well as relative difference in the size of the chambers. Kymography is valuable in showing mild cardiac damage and indicates chamber enlargement. Kymographically, early muscle damage may often be shown before it is clinically evident by decreased motion of the chamber outline, changes in the type of motion, and doubling of the systolic peaks. A lack of response in heart size to the Valsalva procedure also indicates muscle damage. Paradoxical motion points to aneurysm of the heart wall.

The author feels that to appraise an individual case requires exhaustive correlation of the clinical, roentgenographic, fluoroscopic, kymographic, and electrocardiographic findings.

Twelve roentgenograms; 2 electrocardiograms; 3 tables.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Angiography in the Localization of Foreign Bodies in the Heart. Edwin M. Goyette and Marvin M. Keirns. Am. Heart J. **42:** 362–369, September 1951.

It is frequently necessary to know the exact location of foreign bodies associated with the heart and great vessels to determine whether or not they can be removed surgically. Foreign bodies embedded in the interventricular septum are difficult or impossible to remove. Reports of two cases of cardiac foreign bodies are presented in detail, illustrating the use of angiography in their localization. The technic of the procedure is described.

In one patient, the foreign body appeared to be located in the interventricular septum, and removal was not attempted. In the other case it was felt that the foreign body was definitely localized within the right ventricle and that it probably would be accessible to surgical removal. At surgery, the fragment was located within the right ventricle, but it projected slightly deeper into the interventricular septum than the angiocardiographic studies had shown. It was successfully removed. Possibly it had moved slightly in the three months intervening after the diagnostic studies. This suggests that contrast studies should be carried out within a few days prior to operation.

Nine roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

THE DIGESTIVE SYSTEM

Spontaneous Rupture of the Esophagus. Report of Two Patients Treated Surgically with Survival. John P. Carter, E. Meredith Alrich, and E. Cato Drash. Surgery **30:** 500–505, September 1951.

Two cases of spontaneous rupture of the esophagus are presented and a table summarizing 12 cases from the literature is included. This is a relatively rare lesion, although it was first recognized in 1724. The first report of survival following operation is that of Barrett (Brit. J. Surg. **35:** 216, 1947). The patient usually gives a history of vomiting followed by severe and continuous pain, with prostration and shock. Examination of the chest often reveals signs of hydrothorax or pneumothorax. X-ray examination of the chest is helpful in confirming such observations and in demonstrating air behind the heart. The diagnosis may be proved fluoroscopically by allowing the patient to swallow a small amount of Lipiodol, which leaks into the mediastinum or pleural space.

One of the authors' patients was submitted to laparotomy that might have been avoided had an x-ray examination of the chest been done. In the other an earlier chest x-ray study would have resulted in more prompt diagnosis.

One table.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Erosion of the Esophagus by an Intrathoracic Goiter. Morris Davidson and Jack L. Turner. Ann. Otol., Rhin. & Laryng. **60**: 631–634, September 1951.

A survey of the medical literature fails to reveal any instance of erosion and penetration of the esophagus due to an intrathoracic goiter. The authors' patient was a 64-year-old white male laborer who complained of dysphagia and discomfort in the throat of twenty-four hours duration. He gave a history of goiter for twenty-five years.

Physical examination revealed a large, firm mass in the neck which was apparently a greatly hypertrophied thyroid gland. X-ray examination failed to show the presence of a foreign body in the esophagus. At esophagoscopy a moderate-sized bolus of meat was discovered and removed in one piece through the esophagoscope. Four centimeters below the cricopharyngeus, on the left posterior esophageal wall, a smooth mass was seen protruding into the lumen of the esophagus. The area around the mass was clean and no blood was noted. A portion of the mass removed for study contained "a fragment of necrotic tissue debris with loss of all identifiable architecture and large fragments of homogeneous pink-staining material having the appearance of colloid fragments of thyroid tissue with small calcific foci."

Two weeks later, a barium-swallow examination of the esophagus was performed. The trachea and esophagus were seen to be deviated to the right and posteriorly by a large superior mediastinal mass, partially calcified and bulging into the anterior cervical region and over the manubrium of the sternum. An irregularity was noted in the mucosa of the esophagus on its posterior left medial aspect. The enlarged superior mediastinal mass was thought to be an enlarged substernal thyroid gland. The irregularity of the esophageal mucosa would indicate esophageal erosion.

Surgical removal of the intrathoracic goiter was refused by the patient.

Two roentgenograms. STEPHEN N. TAGER, M.D.
Evansville, Ind.

Congenital Tracheo-Oesophageal Fistula with Ectopic Anus. David L. Dey. M. J. Australia **2**: 296, Sept. 1, 1951.

The author reports a case of congenital tracheo-esophageal fistula (Vogt's Type III) associated with an ectopic anus in a newborn child. An interesting radiographic finding was a deformity of the second thoracic vertebra, suggesting the possibility of some segmental factor in the production of the condition. Operative correction of the abnormalities was successful.

Gastro-Oesophageal Regurgitation. N. A. Lawler and N. D. McCreath. Lancet **2**: 369–374, Sept. 1, 1951.

In a large number of patients with so-called functional or nervous dyspepsia, the symptoms are due to gastro-esophageal regurgitation. Although esophagitis and esophageal ulcer often develop, the symptoms are present and the condition can be recognized before the occurrence of inflammatory or ulcerative changes.

Substernal or high epigastric pain occurs, often extending to the suprasternal notch, related not to food but to posture, coming on when the patient lies down or bends forward. In over half the authors' cases the pain was felt not only under the sternum but also in one or more of the following places; in the back between the scapulae, in the left half of the chest, in the left shoulder, up either side of the sternum, and occasionally behind one or both ears. About half the patients complain of acid regurgitation into the mouth. Symptoms are more or less constantly present for years.

The clinical diagnosis can be confirmed only by fluoroscopy. In 56 cases studied by the authors during the past year, regurgitation of the gastric contents into the esophagus was demonstrated in all but 3. Testing for reflux adds little to the time of the usual fluoroscopic examination. First, while the patient is in the erect position, the potential ability of the diaphragmatic hiatus to close the lower end of the esophagus is tested. This is done by screening and taking a film of the barium-filled esophagus while the patient holds his breath in full inspiration. The patient should be given at least a pint of barium, followed by a few mouthfuls of water to clear the esophagus. Two standard positions are used when examining for reflux: For the first position the patient is instructed to place himself lateral to the screen and to bend forward as if to touch his toes. When regurgitation takes place, it is easily seen through the translucent lung fields. This position is also useful for demonstrating a hiatal hernia. For the second position, the table is lowered to, or slightly beyond, the horizontal, and the left side of the supine patient is raised slightly from the couch. The gastro-esophageal junction is shown in profile and the esophagus is displaced slightly from the spine. Several minutes may elapse before the retaining mechanism relaxes and barium flows into the esophagus, and the patient may be able to inform the examiner that regurgitation has taken place. Many normal patients examined in the second position show a peak of barium projecting into the cardia from the gastric contour. In patients in whom regurgitation is delayed, this peak is always present.

In the authors' experience, when regurgitation takes place, the barium invariably fills the whole of the viscus to the level of the upper or cricoid sphincter. It is almost always prevented from entering the pharynx by the closure of this sphincter. Immediately the esophagus is filled, a broad peristaltic wave begins at its upper end and sweeps the column of barium downward toward the cardia. The lower end of the esophagus is dilated momentarily, and all of the barium may be forced back into the stomach. The sequence of events may be so rapid that it is impossible to take a film of the phenomenon. More often the peristaltic wave is wholly or partially ineffectual, the esophageal ampulla is widely dilated, and the barium escapes in a reverse direction past the peristaltic contraction. This may happen several times, wave after wave of peristalsis passing down the esophagus in a vain attempt to rid it of its contents. Reverse peristalsis is also commonly seen. The pressure built by the peristaltic wave sweeping downward against the upflowing barium dilates the lower end of the esophagus and is probably a major factor in producing pain.

Esophagitis and esophageal ulcer are common results of persistent or frequent gastro-esophageal regurgitation, and not infrequently can be diagnosed or strongly suspected from the radiologic examination.

Sliding or fixed hiatal hernia was found in 34 of the authors' cases. In all of these regurgitation took place,

although the reflux was occasionally held up momentarily at the junction of the esophagus with the hernial pouch. The identification of gastric mucosa in the pouch is the only reliable roentgen evidence of hiatal hernia and differentiates it from esophageal ampulla.

In the routine barium examination of 591 consecutive new cases, peptic ulceration was demonstrated in 181 patients and gastro-esophageal regurgitation in 63 (including 7 pregnant women). Four of the patients with regurgitation also had peptic ulceration of the stomach or duodenum and presented symptoms of both conditions. In 45 of 151 new cases of dyspepsia referred to the medical outpatient department the symptoms were due to gastro-esophageal regurgitation.

Eight roentgenograms.

Primary Lymphosarcoma of the Stomach. Report of Three Cases and Review of the Literature. Ts'ui-Ting Huang, Shao-hsun Wang, Ch'uan-i Feng, and Li-min Fei. Chinese M. J. **69**: 310–327, July-August 1951.

Three cases of primary lymphosarcoma of the stomach are reported. Two of the patients were males; all were under thirty years of age. One patient had had symptoms for five months and one for one year. The other patient gave a history of occasional epigastric pain for ten years, with an exacerbation of this symptom in the last six months. It is thought that this patient probably had been suffering from gastritis.

Roentgen findings in lymphosarcoma of the stomach are not sufficiently characteristic to permit a specific diagnosis. However, in the experience of the authors and other writers, the presence of gastric peristalsis with a carcinoma-like lesion and the absence of peristalsis with multiple polypoid growths should be regarded as important points in favor of a diagnosis of lymphosarcoma. In one of the authors' cases a correct preoperative diagnosis was made when extensive nodular growths were seen along the entire greater curvature, with a large filling defect at the angle between the body and antrum, protruding into the gastric lumen and causing compression of the rugae along the lesser curvature, with no peristalsis visible.

One case was inoperable. Irradiation was given following exploration. The patient died three months later, and at autopsy no infiltration of the gastric wall by tumor cells was found. In each of the other 2 cases the tumor was completely resected, with irradiation postoperatively. One patient is living and well after eleven years and the other after a year and a half.

Four roentgenograms; 6 photomicrographs; 2 photographs.

Perforation of the Stomach in the Newborn Infant. A Report of a Survival. Huston G. Kellogg, Sol M. Abelson, and Forest A. Cornwell. J. Pediat. **39**: 357–362, September 1951.

The authors report what they believe to be the second case of perforated gastric ulcer in a newborn infant ever operated upon and the only survival recorded in the literature. Serial roentgenograms showed that the perforation was not congenital. This case reaffirms the value of x-ray examination of the abdomen as a diagnostic aid in the newborn infant.

Early diagnosis, early use of antibiotics, and early surgical repair made survival in this case possible.

Three roentgenograms; 1 photograph.

Fistula Gastroduodenale (Bulbar). Report of Two Cases. Savas Bissylas. J. Canad. A. Radiologists **2**: 48–50, September 1951.

Spontaneous gastroduodenostomy is said to be relatively uncommon, but no bibliography is submitted. Two cases are presented, one the result of an ulcerative gastric carcinoma penetrating to the duodenal cap, and the other secondary to what appeared to be a peptic ulcer of the lesser curvature of the stomach. Both patients improved following perforation. The first gained 10 pounds and stopped vomiting before final deterioration and death. The other felt so well he refused surgery.

Films from each case before and after establishment of the fistula are reproduced.

Four roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Gastroileostomy and Gastrocolostomy. Report of Three Cases. Rudolph M. Landry. Surgery **30**: 528–533, September 1951.

A report of three rare surgical errors resulting in gastroileostomy and gastrocolostomy are reported. Twenty-eight such cases were found in a review of the literature. The severity and type of symptoms depend (1) upon whether a portion of the stomach has been resected, (2) upon whether the pylorus is patent, (3) upon the site of the stoma, and (4) upon the presence of ulceration at the stoma. The symptoms include diarrhea; nausea and vomiting (in about half the cases); abdominal pain, which usually does not occur unless ulceration is present; loss of weight in proportion to the amount of food diverted and the length of intestine that has been de-activated; weakness, anemia, and dependent edema, which are signs of malnutrition. The diagnosis can usually be made from the history, but should be confirmed roentgenographically. Careful roentgenographic studies may be necessary to visualize the lesion and follow-up examination should be done after the barium has passed beyond the stomach. The necessity of repair at a later date, if feasible, is stressed.

Three roentgenograms; 1 photograph.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Some Physiological Aspects of Intestinal Obstruction. Charles F. Hyndman. J. Canad. A. Radiologists **2**: 43–47, September 1951.

Roentgen studies, if used intelligently with clinical studies, can contribute much in the various types of intestinal obstruction. Practically all of the information is derived from the gas patterns seen—their presence or absence, size, shape, distribution, presence or absence of associated fluid levels, etc. Normally gas may be seen only in the stomach and colon. Though present in the small bowel, it is so thoroughly mixed with the fluid content by peristaltic action that it cannot be demonstrated. When stasis occurs, the gas separates from the fluid and both may be visualized roentgenographically.

Inhibition ileus, due usually to peritonitis, shows gas in the entire intestinal tract, with fluid levels but no "hair-pin" turns. A localized inhibition type of ileus, such as is seen in pancreatitis, may cause distention of a "sentinel" loop of small bowel. Serial films in inhibition ileus show little change.

Mechanical obstruction usually causes more distention of individual loops, with formation of gas and fluid levels and "hair-pin" turns. Fairly rapid changes are evident in serial examinations. The space between the loops is a good indication of the thickness of their walls and hence a clue to the thickness of their peritoneal covering. [In mechanical obstruction of the colon it must be remembered that in some cases the small bowel does not become distended because the ileocecal valve remains competent (at times even to the point of gangrene and perforation of the cecum).]

Films from four cases are reproduced, illustrating inhibition ileus and small and large bowel obstruction.

Eight roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Pneumatosis Cystoides Intestinalis. S. Schorr, T. D. Ullmann, and S. Laufer. Arch. Int. Med. **88:** 362–372, September 1951.

The authors report a single case of pneumatosis cystoides intestinalis in which the diagnosis was made roentgenologically and confirmed four years later at autopsy.

The cause of this condition is unknown. Neoplastic, infectious, and mechanical theories have been advanced. None is tenable. In many of the case reports appearing in the literature, mention is made of a poor nutritional state, suggesting that an avitaminosis, in association with the obstructive lesions commonly present, may play a role.

The roentgen appearance is quite characteristic. Frequently, but not invariably, there is present a persistent pneumoperitoneum without clinical evidence of a perforated viscus. The buoyant small intestinal loops may become interposed between the liver and diaphragm. The gas cysts themselves are in many instances clearly visible, presenting a foam-like appearance. Occasionally the cysts are large enough to compress the barium-filled intestine, producing a chain of small filling defects.

Four roentgenograms; 3 photographs; 1 photomicrograph. SAM FINCK, M.D.
Mt. Sinai Hospital of Cleveland

Intestinal Obstruction Produced by Failure of Intestinal Rotation. Description of a Case. R. Spencer. Brit. J. Surg. **39:** 105–111, September 1951.

The author introduces his report of a case of intestinal obstruction due to failure of intestinal rotation by outlining the embryology of the midgut. Failure or alteration of the usual sequence of events leads to an aunormal disposition of the fully developed alimentary tract. The finding of non-rotation or malrotation is related to the stage of embryologic development at which the variation took place.

Whatever the particular type of anatomical anomaly, the patients may be classified into three groups: (1) those with true volvulus neonatorum, presenting in the earliest stage of life; (2) those with less acute symptoms, occurring intermittently; (3) those in whom the condition goes unrecognized or is discovered accidentally. The symptoms are influenced by two factors: first, by the partial obstruction of the upper alimentary canal at the duodenojejunal flexure by the twisted mesentery crossing the duodenum or by an adventitial peritoneal band or adhesion; secondly, by the volvulus itself, which consists of a large mass of intestines, the blood supply of which is very precarious. Clinically, it is the duodenal obstruction which predominates in the early stages.

The true volvulus neonatorum of early life must be differentiated from congenital hypertrophic pyloric stenosis, congenital atresia, intussusception, and obstruction caused by tumors or bands.

The author's patient was a child of one year and ten months, with a sudden onset of abdominal pain and vomiting. There was no movement of the bowel for eight days. Plain films of the abdomen showed no abdominal gas shadows or fluid levels indicative of intestinal obstruction, and a barium meal study was undertaken. The barium entered the duodenum in a few minutes but at the end of one and a half hours had not passed into the jejunum. Barium enema studies revealed no passage of the contrast substance beyond the right portion of the transverse colon. At operation a volvulus was found which included a portion of the mesentery of the small bowel, cecum, and ascending colon. This was untwisted by rotating the mesentery two and a half turns in an anti-clockwise direction. Associated with the volvulus was an obstruction involving the first 9 inches of the jejunum, which was bound down to the posterior abdominal wall by a vascularized sheet of peritoneum. Division of the sheet was accomplished and recovery ensued.

The twisted gut is usually not distended, indicating patency of the lumen at the distal end. Its color is surprisingly good because the blood supply is not grossly interfered with. Melena is rare.

In the case reported the diagnosis was suggested when the barium meal was held up in the duodenum, and the barium enema failed to fill the cecum. In newborn infants a barium meal is contraindicated. Lipiodol may be given by mouth or introduced by an intranasal tube passing down the esophagus.

At operation a search should be made for adventitious bands and adhesions in addition to the major rotation.

Two roentgenograms; 2 drawings.
MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Intestinal Volvulus Precipitated by Lead Poisoning. Report of Five Cases. Knute E. Berger and Einar A. Lundberg. J. A. M. A. **147:** 13–16, Sept. 1, 1951.

Five cases of coincident lead poisoning and intestinal volvulus are reported in which the authors believe that the volvulus was the result of the plumbism. All the patients worked in a lead plant and all had undeniable evidence of intoxication. Four of the cases involved the sigmoid colon and one the small intestine.

These patients were Peruvians, living and working at a high altitude (12,200 feet), and this is believed to play a part in the development of a redundant sigmoid, a very common finding in such regions.

It is very important to make a correct diagnosis in this situation since the volvulus demands immediate surgery while some of the measures used for lead poisoning (prostigmine, morphine) may aggravate the obstruction or mask symptoms until too late. This happened in the authors' first case.

[Since volvulus is said to account for 50 per cent of the bowel obstructions seen at the authors' hospital, one canot help wondering if the two conditions were not merely coincidental.—Z. F. E.]

Four roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Irreducible Gangrenous Intussusception. Victor E. Tedesco. Am. J. Surg. **82**: 526–530, October 1951.

A successful primary resection for irreducible gangrenous intussusception in a 6-month-old infant is reported. Few such recoveries have been recorded. The case is presented to illustrate the danger of error in the barium enema method of diagnosis and the hydrostatic pressure method of reduction of intussusception.

The infant was admitted to the hospital with a history of vomiting and bloody stools for fifteen hours. He appeared to be in no distress except at intervals when he would roll from side to side, draw up his hands, and scream out in pain.

A hard mass, observed by the parents seven hours before admission, was palpable to the left of the umbilicus when the abdomen was relaxed between intervals of colic. The mass could not be palpated on rectal examination, but the stool was bloody. A diagnosis of intussusception was made, and a barium enema study was undertaken for confirmation. Following this procedure the mass disappeared and fluoroscopic examination showed apparent filling of the entire colon. It was thought that reduction had been accomplished and that it was safe to observe the patient further. Eleven hours later he vomited some yellowish fluid. A small amount of pink chalky stool was obtained on the second day. On the third day a large amount of the morning feeding was vomited, and a blood-stained chalky bowel movement was obtained that night. On the fourth day the baby was extremely restless and vomited at intervals. The abdomen became distended. No masses were palpable, abdominally or rectally, although blood was noted on the examining finger. A roentgenogram taken in the erect position revealed fluid levels and accumulation of gas. A barium enema examination showed the medium to reach only as far as the splenic flexure.

At operation, a mass of intussuscepted bowel was palpated in the region of the transverse colon extending to the splenic flexure. It was possible to reduce the intussusception with the exception of the base of the appendix and ileocecal portion of the intestine. A gangrenous perforation at the ileocecal valve and several areas of early gangrene of the ascending colon and thrombosis of the ileocolic vessels were found. The terminal 3 inches of the ileum, the cecum, ascending colon, and right half of the transverse colon were resected.

When last examined, at the age of six years, the patient was well developed, with normal bowel habits and well formed stools.

Three roentgenograms.

Multiple Lipomas of the Duodenum: A Case Report. William G. Kirkland and Randal A. Boyer. Gastroenterology **19**: 142–147, September 1951.

The authors state that multiple duodenal lipomas have been discovered at autopsy in 4 cases and that their case is the second one to be uncovered by surgical intervention.

Gastro-intestinal examination showed dilatation of the duodenal cap, with stasis. The entire second portion of the duodenum was dilated in a similar degree, and on compression multiple smoothly rounded, broad-based polypoid defects were seen to protrude into the lumen. Gross and histologic examination of the tissues removed showed masses of mature fat cells consistent with a diagnosis of lipoma.

The multiplicity of the lesions in this case was an unusual feature. The roentgen criteria of Schatzki and Hawes (Am. J. Roentgenol. **48**: 1, 1942) for an intramural, submucosal tumor, consisting of a smooth filling defect with a sharp angle at the point where the tumor meets the uninvolved wall of the bowel, as seen in profile, were largely fulfilled.

Three roentgenograms. DANIEL WILNER, M.D.
Atlantic City, N. J.

Diverticulosis of the Jejunum—A Clinical Entity. I. M. Orr and J. Y. W. Russell. Brit. J. Surg. **39**: 139–147, September 1951.

The authors report a series of 13 cases of diverticulosis of the small intestine. All involved the jejunum and 2 the ileum as well.

The typical diverticulum represents a herniation of the mucous membrane of the jejunum through the muscle wall of the intestine at the site of entry of the blood vessels. Most diverticula are on the mesenteric border of the intestine and are acquired. Congenital diverticula are more likely to be found on the opposite side.

Patients with diverticulosis of the small intestine may be divided into three groups as follows:

1. Those who exhibit no symptoms at all. These cases are found incidental to other studies or at autopsy.

2. Those who have mild chronic indigestion, some probably due to the irregular bowel contractions which predispose toward the formation of diverticula, though the diverticula themselves may also give rise to symptoms owing to failure to empty completely, with resulting catarrhal changes within the lumen. More severe symptoms may occur if the excretions become blocked or if concretions form within the pocket.

3. Those who suffer from an acute abdominal catastrophe due to a complication arising in one or more of the diverticula. Among these major complications are: (*a*) acute diverticulitis resulting in perforation, adhesions, stricture, or cyst formation; (*b*) hemorrhage; (*c*) concretion formation; (*d*) traumatic rupture; (*e*) foreign-body impaction; (*f*) infestation with intestinal parasites.

Any patient suffering from vague dyspepsia not otherwise accounted for should be examined radiologically with diverticulosis in mind. To see the barium filling a jejunal pouch, the meal should be followed at half-hour intervals. If a diverticulum is demonstrated and is tender on palpation under the fluoroscopic screen, it may be assumed to be the cause of the patient's symptoms.

For milder cases medical measures may be undertaken.

Surgery is indicated when the symptoms are more severe or in the presence of hemorrhage or other complications.

Eleven figures, including 5 roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Diverticulosis of Jejunum with Hemorrhage. Edmund H. Berger, Clarence W. Brunkow and Clarence W. Smith. Am. J. Med. **11**: 398–402, September 1951.

There are two types of diverticulum of the intestine, congenital and acquired. When all layers of the intestine are present in its wall, a diverticulum is said to

be a true diverticulum. Acquired diverticula are composed of mucous membrane supported by little or no smooth muscle. They are located at a site where a blood vessel leaves the mesentery and enters the bowel, offering a point of decreased resistance. The increased intestinal pressure caused by irregular contractions of the small intestine is also a factor in their production.

The majority of patients with diverticula of the small intestine have no distinctive symptoms. Some complain of vague abdominal pains and gas at varying intervals after meals. Bleeding occurred in about 6 per cent of the reported cases; in most instances it was intermittent and not severe.

Diverticula of the jejunum are rare. A diagnosis can be made only by keeping the entity in mind. Careful roentgenologic examination of the upper jejunum may reveal the characteristic balls of barium within the diverticula.

Two cases of acquired diverticula of the jejunum associated with hemorrhage are reported. In each the diagnosis was made preoperatively on x-ray examination. Treatment consists of surgical removal of the involved segment of jejunum. In one of the authors' cases the significance of the jejunal diverticula was not recognized at the time of first operation. Their importance was appreciated when bleeding continued postoperatively, and the involved segments were removed.

Three roentgenograms; 1 photograph.

Dissecting Aneurysm Simulating Large Bowel Obstruction. Henry W. Mayo, Jr. Am. J. Surg. **82**: 522–525, October 1951.

A case of dissecting aneurysm of the aorta presenting symptoms and signs of large bowel obstruction is reported. A 48-year-old Negro was admitted to the hospital with a history of epigastric pain developing suddenly five days previously. The pain occasionally radiated through to the back. During the five-day period there had been two watery stools, the last one on the day of admission. The patient stated that he had had "twenty hip shots" seven years previously, but the Wassermann and Kline tests were negative. The abdomen was rounded, moderately distended, and tympanitic except in the hypogastrium. A scout film of the abdomen showed marked distention of the entire large bowel down to the mid sigmoid region, suggesting obstruction at that point. There was no gas in the rectum or terminal sigmoid. Several loops of slightly dilated small bowel were also noted. A Miller-Abbott tube was passed into the abdomen and during the night was allowed to pass on down into the lower small bowel. On proctoscopic examination a constriction of the lumen was found at 9 inches, but no mucosal ulceration or other lesion was seen. The first film of a barium enema study revealed a distended colon filled with barium; the post-evacuation film, however, showed the colon to be fairly well constricted. A large quantity of gas had been evacuated with the barium.

The patient's condition improved somewhat, but two days later the abdomen was again distended and tympanitic, with recurrence of the pain. The temperature ranged from 98.6° to 101°F. Barium enema examination was repeated, with the same findings and temporary deflation. The Miller-Abbott tube was clamped off and, since distention did not immediately recur, was removed the following day. The patient continued to pass flatus, but complained of vague, intermittent, left-sided abdominal pain radiating through to the back. On repeat proctoscopy the constriction at the 9-inch level was found to have disappeared. A chest film was normal except for mild left ventricular hypertrophy and some elongation and tortuosity of the thoracic aorta. X-ray examination of the upper gastro-intestinal tract showed no abnormality.

On the ninth hospital day, the patient suddenly fell from his chair to the floor, and after gasping for breath a few minutes died. Postmortem examination disclosed the descending aorta involved in a dissecting aneurysm down to the point of origin of the inferior mesenteric artery. Distal to this point the aorta was markedly constricted. The aneurysm had ruptured in its upper segment, with retropleural hemorrhage. No obvious changes were present in the bowel.

If the index of suspicion had been higher with regard to dissecting aneurysm, the sudden onset of abdominal pain, radiating to the back and accompanied by obstructive signs and fever, might have suggested the correct diagnosis. The patient's previously healthy condition was against a carcinoma of the large bowel. Volvulus of the sigmoid was the first diagnosis considered, and reduction was thought to be signified by the deflation following the barium enemas, though the x-ray picture was never typical of volvulus. The intermittent episodes of pain, distention, and obstruction may be explained on the basis of intermittent ischemia of the bowel secondary to the aneurysm.

Three roentgenograms; 1 photograph.

A New Method for Obtaining Barium Enemas in Colostomy Patients. Frederick S. Cross. Surgery **30**: 460–464, September 1951.

To emphasize the importance of barium enema studies in colostomy patients, the author cites series of cases reported by Mayo (Proc. Staff Meet., Mayo Clin. **17**: 181, 1942) and Berson and Berger (Surg., Gynec. & Obst. **80**: 75, 1945) indicating the frequency of polyps and of subsequent malignant tumors in persons who had undergone resection of the colon or rectum for carcinoma. He describes a method of examination for such patients which obviates the disagreeable features associated with procedures commonly used.

The method described makes use of a Rutzen type ileostomy bag and No. 22 Bardex catheter fitted with a stopper, several corks, a 50-c.c. syringe, and a hemostat. It is necessary to enlarge the hole in the face plate of the ileostomy bag, due to the fact that colostomies are in general larger than ileostomies.

With this procedure, the evacuated barium goes into the ileostomy bag instead of soiling the patient, the x-ray table, and the floor; the patient is spared embarrassment and some examinations are obtained with might otherwise have been impossible. At no time should the bag be allowed to become overdistended and heavy with fluid, for this will cause it to pull away from the skin, and leakage will result.

Thirty patients have been studied by this method and satisfactory fluoroscopic examinations and films have been obtained in all.

One roentgenogram; 2 photographs.

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Shreveport (La.) Charity Hospital

New Method of Radiological Exploration of the Pancreas in the Child. G. Sansone, N. Macarini, and L. Oliva. J. radiol. et d'électrol. **32**: 726–733, 1951. (In French)

A method of roentgen examination of the pancreas in children is described. It consists in first injecting the retroperitoneal area with oxygen (method of Ruiz Rivas) followed by gastric insufflation, which may be obtained with gas-producing powders (such as Seidlitz powders). Following this, standard frontal and lateral films, as well as frontal, lateral, and axial stratigrams are taken. The pancreas is visualized as a relative opacity posterior to the stomach.

Eleven roentgenograms.

CHARLES M. NICE, M.D.
University of Minnesota

Pseudocyst of the Pancreas in Childhood. James Mithoefer. Pediatrics **8**: 534–541, October 1951.

In a search of the literature, the author was able to find only 2 authenticated cases of pseudocyst of the pancreas in children. He reports a case in a 20-month-old girl who was admitted to the Cincinnati Children's Hospital with swelling of the abdomen. Eight months before, she had fallen from a porch. Within a few days a febrile prostrating illness accompanied by abdominal pain supervened. This was thought to be bronchopneumonia. After an interval of six months, abdominal swelling appeared and led to laparotomy at another hospital. A diagnosis of tuberculous peritonitis was made, and abdominal paracentesis was performed at weekly intervals until admission to Children's Hospital.

The child was emaciated and appeared chronically ill. Lymph nodes were palpable but not remarkably enlarged. The abdomen was hugely distended and presented signs of free peritoneal fluid. Roentgen examination showed elevation of both sides of the diaphragm with compression of the lungs. The abdomen was greatly increased in size and of a uniform density. Gastro-intestinal studies showed the stomach to be displaced upward, to the right, and anteriorly. The duodenal loop was greatly widened. The ascending and transverse portions of the colon were displaced anteriorly. The space between colon and stomach was occupied by a large homogeneous mass of "water density." Retrograde pyelography showed inferior displacement of the kidney but no anterior displacement. Pyelocanalicular backflow was observed. On the basis of the roentgen findings, a diagnosis of pseudocyst of the pancreas was made, and this was confirmed by the demonstration of amylase in the cyst fluid and by surgery. Except for an upper respiratory tract infection and otitis media, the postoperative course was steady and relatively rapid. When last seen, ten months after operation, the patient was entirely asymptomatic.

Roentgenograms made at the time of the illness diagnosed as bronchopneumonia were not available, but it is thought that a paramediastinal shadow, so often seen with acute pancreatitis, may have been mistaken for pneumonitis. At the first laparotomy, performed elsewhere, the surgeon's impression of "tuberculous peritonitis" in the light of subsequent developments probably represented misinterpretation of peritoneal reaction to fat necrosis secondary to underlying pancreatitis.

Three roentgenograms; 4 photographs.

Operative Cholangiography. An Evaluation of 406 Cases. Charles G. Mixter, Louis Hermanson, and Arnold L. Segal. Ann. Surg. **134**: 346–350, September 1951.

A review of 406 cases in which operative cholangiography was done indicates that this procedure will (1) lower the incidence of unnecessary common duct exploration, (2) increase the safety of biliary tract surgery, and (3) avoid secondary operations by demonstrating overlooked stones in the common duct. Best results are obtained by using an operating table with a built-in Bucky diaphragm, although films sufficiently good for interpretation may be obtained with an ordinary cassette placed prior to operation.

The surgical technic consists in ligating the cystic duct at its junction with the gallbladder and then inserting a No. 5 ureteral catheter through an opening just below the tie. The tube is then passed into the common duct for a limited distance to avoid passage into the duodenum and is tied in place. Diodrast, 3 to 5 c.c., is injected and an exposure is made. An additional 5 to 10 c.c. of Diodrast is then injected and a second film is obtained. Fractional injection is used to avoid spasm of the sphincter of Oddi, which may occur if the ducts are rapidly distended to full capacity.

Choledochostomy, in general, is being performed largely on the basis of the usual clinical indications. It is not surprising, therefore, that approximately 50 per cent of all common duct explorations are unnecessary. The use of choledochostomy has accounted for a substantial increase in mortality as well as doubling the morbidity rate. It has been pointed out that approximately 80 per cent of benign strictures are due to trauma to the ductal system sustained at the primary operation.

The authors state that the use of operative cholangiography has enabled them to lower materially the incidence of negative common duct exploration with all the aforementioned hazards. On the other hand, it should be pointed out that if the cholangiogram alone had been depended upon, detritus in the ducts would have been overlooked in 9 cases. This error can be reduced by observing the nature of the bile aspirated from the common duct. If muddy bile or particulate matter is obtained, choledochostomy should be carried out regardless of the cholangiogram.

Six tables.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Laminagraphy of the Gallbladder and of the Bile Ducts: Preliminary Contribution. R. Bauer. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 159–165, August 1951.

Although x-ray visualization of the gallbladder by means of modern contrast media has reached almost a stage of perfection, there are still cases in which, due to the superimposition of gas or other causes, the results are doubtful. In these cases, additional information may be obtained by laminagraphy. Very little has been published about this method of examination, though Levene and Perkins recently reported 3 cases in which, without the use of contrast media, gallstones which had not been seen on the plain scout film were demonstrated laminagraphically. The writer has been able by this means to differentiate between gallstones on the one hand and kidney stones, calcified mesenteric nodes, calcifications within the costal cartilages, etc., on the other.

He uses a Universal Planigraph made by Siemens, which permits taking films in the erect as well as the recumbent position. The usual contrast medium for the visualization of the gallbladder is given, and at the proper time the patient is placed on the table in the prone position. The gallbladder is first localized by means of fluoroscopy, and planigraphic films are then taken at levels about 0.5 cm. apart, from about 2.0 cm. from the external abdominal surface to a depth of 4.5 cm., or more if necessary. Ordinarily, four exposures can be made on a 10 × 12-inch film.

For the visualization of the bile ducts, the patient is placed in the recumbent position, and the films are taken after a fatty meal. The proper depth in this position is a little more difficult to find, but the visualization of the ducts is very satisfactory.

Thirteen roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.

ABDOMINAL-THORACIC FISTULA

Origin and the Roentgen Diagnosis of Abdominal-Thoracic Fistula. F. Caspers. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 322–328, September 1951. (In German)

Abdominal-thoracic fistula is a complication of inflammatory processes in the abdomen or chest. In a collected series of 652 cases the author found that 84.4 per cent were secondary to abdominal disease.

The fistula usually arises as a result of a prolonged inflammatory condition, not necessarily forming free pus or an exudate. Ulcer and carcinoma of the stomach, abscess and secondary carcinoma of the liver, abscess of the spleen, and tumors and abscesses of the lung are the commonest causes in organs adjacent to the diaphragm. The fistulous opening is often by the perispinal route, and actual perforation of the diaphragm through its thicker portions is infrequent.

The author describes a case secondary to a gunshot wound at the level of the fourth lumbar vertebra with subdiaphragmatic abscess and a fistulous tract passing through the diaphragm into a bronchus.

The author's second case was one of paranephric abscess in a twenty-year-old man. When opaque material was injected into the fistula, it was seen to extend through the diaphragm, perforating a bronchus.

A third patient was a thirty-year-old man thought to have a paranephric abscess because of lumbar pain. This later proved to be caused by tuberculosis in a vertebra with a fistula extending into the esophagus.

The author points out the importance of the recognition and treatment of these fistulae. He advocates filling the fistulous tract with opaque medium, followed by fluoroscopy, particularly in the Trendelenburg position, with film records as proof of the extent and nature of the condition.

Ten illustrations, including 8 roentgenograms; 1 table.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

THE MUSCULOSKELETAL SYSTEM

Neurogenic Ossifying Fibromyopathies. H. C. Fett and J. G. Yost. Am. J. Surg. **82:** 517–521, October 1951.

Ossification of the capsule and neighboring structures in the region of the joints is one of the three pathologic changes that may occur in paraplegic extremities (the other two are osseous and muscular atrophy and osteoarthropathy of the Charcot type). It is characterized by the formation of a mature, trabeculated, spongy type of bone in the joint capsule and tendons in the region of the capsule, marked osteoporosis of the neighboring long bones, and the preservation of the cartilaginous surfaces of the joint as well as the preservation of the joint space. The involved joints are always below the level of the cord lesion but the degree of trauma to the cord and other parts of the body bears no relationship to the extent of involvement. Once formed, these calcifications are permanent. Return of function to the paralyzed limb does not influence resolution of the osseous deposits.

Two cases of neurogenic ossifying fibromyopathy involving the upper extremity, one bilateral, are reported. These cases demonstrate that the involvement is completely extra-articular and that mobilization of neighboring joints with return of muscle power does not promote regression of the lesions. One case shows how small joints, where pressure is minimal, are also involved, and that even with early mobilization the lesions may occur. Decubitus ulcers or other ports of entrance for infection are not essential. Roentgenograms of the elbow of the second patient, fourteen years after his injury, still showed periarticular ossification with preservation of the joint space.

Four roentgenograms; 2 photographs.

Congenital Stippled Epiphyses. G. David Ford, Martin Schneider, and James R. Brandon. Pediatrics **8:** 380–392, September 1951.

Two cases of stippled epiphyses, one in a premature infant, are reported. The characteristic features of the entity are the presence of multiple, discrete, dense calcifications in many cartilaginous epiphyses and apophyses. The onset seems to be in fetal life. In the majority of the cases reported, the condition was recognized during the first nine months of life. Although females are predominantly affected (2:1), both of the authors' patients were males. Most of the patients die of pulmonary and/or urinary infections. Dwarfism, of the short limb type, is a usual finding. This feature was outstanding in the first case reported here, so that the initial clinical impression was chondrodystrophic dwarfism.

The diagnosis of stippled epiphyses depends on roentgenographic examination. The discrete stippling in this condition, as opposed to the mottling and epiphyseal irregularity seen in dysplasia epiphysialis multiplex, is quite distinctive. The irregularities of ossification occasionally seen in hypothyroidism have been designated as "stippled epiphyses" by Wilkins (Diagnosis and Treatment of Endocrine Disorders in Childhood and Adolescence, 1950), but in hypothyroidism the stippling appears later in life. Shortened proximal segments of the extremities and bilateral congenital cataracts, when present, give substantial support to the diagnosis of congenital stippled epiphyses.

Sixteen roentgenograms; 2 photographs; 1 photomicrograph.

Fibrous Dysplasia or Fibro-Osteoma. Report of a Case. J. J. Pindborg. Acta radiol. **36:** 196–204, September 1951.

A 22-year-old white male exhibited gross sclerotic

processes in the maxillary, frontal, and occipital bones and the entire base of the skull. No other bones were involved, and there were no signs of generalized disturbance. Histologic examination showed mainly cellular connective tissue with metaplastic new bone formation.

The different terms used in the course of time for similar lesions are reviewed, with particular reference to fibro-osteoma and fibrous dysplasia. For the case recorded the designation fibro-osteoma seems too suggestive of actual tumor formation to be applicable. On the other hand, "polyostotic fibrous dysplasia" is ruled out by the limitation of the process to the skull. Since there is no doubt, however, that the condition is interpretable as fibrous dysplasia, the writer suggests the term "diffuse fibrous dysplasia of the cranial bones."

Two roentgenograms; 5 photomicrographs; 2 photographs. R. W. DICKENHORST, M.D.
Shreveport (La.) Charity Hospital

Compression of Spinal Cord by Osteitis Deformans (Paget's Disease). Giant-Cell Tumor and Polyostotic Fibrous Dysplasia (Albright's Syndrome) of Vertebrae. A Report of Four Cases. Paul Teng, Sidney W. Gross, and Charles M. Newman. J. Neurosurg. **8**: 482–493, September 1951.

A case of Paget's disease of the vertebrae is presented, with paraplegia due to cord compression by the hypertrophic laminal arches of D-1, D-2, and D-3. Laminectomy was followed by slow but progressive return of function.

From 1923 up to the time of this report, a total of 37 cases of Paget's disease of the spinal column with production of spinal cord symptoms had been recorded. Only 3 of the 37 patients were females. Spinal compression occurred most frequently when the thoracic region was involved. Of the 37 collected cases, 31 involved the dorsal vertebrae; in only 3 instances was the lesion localized in the cervical segments. In the remaining 3 the level was not mentioned. The treatment consists in removal of the pressure by laminectomy.

Two cases of giant-cell tumor of the vertebrae are reported, one with involvement of the cauda equina and the other with cord compression. In one patient the tumor involved the laminal arch, the left pedicle, and part of the vertebral body of L-2, causing weakness in the legs, especially the left. A laminectomy of L-2 and L-3 was performed, followed in two weeks by radiotherapy. All neurological symptoms disappeared.

The second patient had a giant-cell tumor of C-6 causing quadriparesis. Laminectomy of C-5, C-6, and C-7 with subsequent x-ray treatment led to slow but satisfactory return of function in the limbs.

Giant-cell tumor is relatively uncommon, probably half as frequent as primary malignant bone tumor. Its occurrence in the spine is comparatively rare. It affects mainly a younger group of patients, in the second and third decades of life.

One case of polyostotic fibrous dysplasia involving the dorsal spine, associated with paraplegia, is presented. The patient had a lesion involving D-7 and D-8, with spinal cord compression. Laminectomy of D-5, D-6, and D-7 was followed by complete recovery. Fifteen months later there was a recurrence of the paraplegia. The spinal canal from D-4 to D-7 was accordingly re-explored, an extradural tumor was removed, and slow, progressive recovery ensued. This patient had other bone lesions which were bilateral, multiple, and extensive.

In 1942 Lichtenstein and Jaffe (Arch. Path. **33**: 777, 1942. Abst. in Radiology **40**: 319, 1943) reviewed 90 cases of fibrous dysplasia. In only one of the series were the vertebrae involved. Schlumberger (Mil. Surgeon **99**: 504, 1946. Abst. in Radiology **49**: 518, 1947) studied 67 cases of fibrous dysplasia involving a single bone, and in only one of these was the cervical spine affected. In neither instance was there evidence of spinal cord compression.

Three roentgenograms; 3 photomicrographs; 1 table. HOWARD L. STEINBACH, M.D.
University of California

Neurologic Complications Associated with Hereditary Deforming Chondrodysplasia. Review of the Literature and a Report on Two Cases Occurring in the Same Family. Alexander Slepian and Wallace B. Hamby. J. Neurosurg. **8**: 529–535, September 1951.

Hereditary deforming chondrodysplasia is a congenital abnormality of osteochondral development resulting in irregularity and arrest in growth at the metaphyseal ends of long bones, causing deformity and the occurrence of multiple cartilaginous masses which, with calcification, become osteocartilaginous.

The authors found in the literature 19 cases in which neurologic complications were directly related to an encroaching osteochondral exostosis. Of 15 cases in which the sex was stated, 14 were in males. The spinal cord was involved in 10 cases, the sciatic nerve in 6, the peroneal in 2, and the brachial plexus and ulnar nerve in 1 case each. Two new cases, occurring in brothers, are described.

One of the two patients was a 33-year-old white man who complained of paresthesias of the left third and fourth fingers and progressive weakness of the fingers and forearm, a descending loss of sensation in the right lower extremity, urgency, frequency, dribbling of urine, and suprapubic discomfort. Roentgenograms showed multiple broad-based osteochondromas, most evident in the left femur and over the fifth and sixth cervical vertebrae.

The other patient was a 37-year-old man who had paresthesias and cramping of the left posterior thigh and recurrent attacks of radiating sciatic pain. Roentgenograms showed diffuse widening of the lower femoral shaft and a large cauliflower-like osteochondroma of the upper femur in the region of the lesser trochanter on the left side. Forearms and legs showed similar widening of the upper and lower shafts with shortening of the forearms and multiple osteochondromas.

Eight roentgenograms; 2 photographs; 2 photomicrographs. HOWARD L. STEINBACH, M.D.
University of California

Juvenile Rheumatoid Arthritis (Still's Disease). J. H. Middlemiss. Proc. Roy. Soc. Med. **44**: 805–815, September 1951.

Rheumatoid arthritis is a systemic disease. In adults, the arthritis is usually the most obvious and important symptom, while in children the bone and joint disturbances may be less important and appear late in the course. Still, in 1897, distinguished between these two groups of cases, but actually they represent the same condition, the juvenile type, or "Still's dis-

ease," being merely a special clinical form generally, but not invariably, encountered at an early age.

The clinical picture of juvenile rheumatoid arthritis at one end of the scale is one of acute onset, joint pains, fever, a rash, leukocytosis, anemia, and possibly pericarditis, with later an adenitis and splenomegaly. On the other hand, the onset may be insidious, with gradually increasing joint pains and swelling, as in the adult type. Between these two extremes all grades may be present. Occasionally psoriasis is associated.

The onset is in most cases between the ages of two and five years, and the sex distribution is about equal. The disease is more virulent in the earlier years of life. In children affected before six years of age, mortality may be as high as 30 per cent.

Pathologically, muscles show atrophy, with small focal perivascular accumulations of lymphocytes and plasma cells. Granulomatous subcutaneous nodules over the ulna and sacrum are often present. In children adhesive pericarditis occurs frequently, while in adults organic heart disease is a not uncommon finding. Lymph nodes, if involved, show hyperplasia. Joint changes consist of marked proliferation of synovial membrane, with hypertrophy of connective tissue in the marrow spaces in the subchondral bone and of vascularization and fibrosis of the joint capsule. As the synovial tissue proliferates, it grows over the articular cartilage, invades it, and becomes adherent to it. If the destruction of the cartilage is extensive, the fibrous adhesions may ossify, producing a bony ankylosis.

Originally, the condition is primarily a synovitis. If a remission occurs early in the disease, the cartilage and bone may escape all injury.

Radiographically, in adults, the first finding is an osteoporosis. In the more acute adult cases, there may also be a periosteal reaction adjacent to the affected joint. Swelling about the joint occurs, and there may be a slight increase in the joint space due to effusion. Subsequently, destruction of the articular cartilage takes place and a diminished joint space results. At this stage it may be possible to observe a localized osteoporosis of the articular cortex, which, with the underlying cancellous bone, may eventually be destroyed. Joints may then become completely disintegrated by contractures due to muscle changes. After the articular cartilage has been destroyed, bony ankylosis may follow. The ends of long bones may be destroyed by synovial proliferation and invasion.

Occasionally, the only alteration seen on x-ray examination is generalized osteoporosis, which is due not to decalcification but to actual removal of bony trabeculae, as demonstrated on magnified fine-grain films.

In children, roentgenographic changes fall into four categories: (1) periosteal change, (2) effect on articular cartilage, (3) effect on bone, (4) effect on growth.

(1) The periosteal change is most often seen along the whole length of a metacarpal or metatarsal and usually on the medial or lateral side, but not on both. The periosteal reaction may resolve completely, leaving no trace, or it may persist as cortical thickening or as a periosteal tag of bone.

(2) The effect on the articular cartilage is one of destruction, partial or complete, slow or rapid.

(3) The effect on bone is primarily osteoporosis. This may be arrested at any stage or may progress to bone destruction by invasion of granulation from the synovium. The destruction may stop at any stage, with return of more normal bone density but without formation of new trabeculae; it may progress and produce subluxation of the joint, or the cartilage may be so destroyed that bony ankylosis occurs.

(4) With regard to growth, there may be (*a*) acceleration of epiphyseal growth or of the growth of ossific centers such as the carpal bones; (*b*) premature fusion of epiphyses leading to (*c*) gross deformities as a result of fusion of one epiphysis while growth in an adjacent one continues; (*d*) a tapering of the juxtaepiphyseal parts of the shafts of long bones, the effect being similar to the destruction at the ends of long bones by synovial proliferation in adults.

Occasionally, the clinical symptoms may be typical while the roentgenograms show only an osteoporosis. The roentgen picture indicates not the general severity of the disease but rather the irreversible joint damage that has occurred.

The joints affected most commonly in the polyarticular form in children are the small joints of the hands and wrists, feet and ankles, and knee joints. In contrast to adults, the cervical spine is involved in about 13 per cent of the cases.

Twenty-eight roentgenograms.

LAWRENCE A. PILLA, M.D.
University of Louisville

Spondylolysis—Spondylolisthesis. Erling Kierulf. Acta radiol. **36:** 253–256, September 1951.

Spondylolysis is defined as a defect in the interarticular portion of the neural arch, while spondylolisthesis indicates "an anterior displacement of a vertebral body and its superior articular processes in relation to the inferior articular processes and the spinal process."

The author reports the case of a heavy worker who had a proved spondylolysis when examined in 1939 because of low back pain. He continued to suffer from pain in the back, and in 1950 further roentgen study revealed a spondylolisthesis. This represents, therefore, a case of spondylolysis with transition into spondylolisthesis, possibly as a result of repeated occupational trauma.

Preceding the presentation of this case is a discussion of various views on the relationship of these conditions.

Two roentgenograms. A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

A Case of Extreme Spondylolisthesis with Lumbosacral Luxation and Overriding of the Luxated Vertebrae. Alvaro Rodríguez Villarreal. Radiología (Panamá) **1:** 236–238, September 1951. (In Spanish)

In pelvic examination of a 38-year-old woman with gynecological complaints, a bony mass was found corresponding to a greatly protruding sacral promontory. A step-like depression was observed just above the sacrum. The patient was short of stature with a disproportion between the limbs and small trunk. Her ribs seemed to be in contact with the iliac crests; the abdomen was pendulous. Upon questioning, the women mentioned pain in the lower ribs aggravated by moderate exercise and by lifting of heavy objects. After heavier than average work she experienced a more severe girdle pain, which diminished on repose. She gave a history of a difficult labor some twenty years earlier, following which she noticed "a little throne" in her spinal column. From then on she suffered from pain in the back radiating to the lower limbs, gradually increasing in frequency and intensity so that about six

years post partum she was paraplegic, with vesicorectal incontinence. After about one year the incontinence disappeared and some motility of the legs was regained. With great will power the patient forced herself to exercise and finally was able to walk again. Her height had diminished.

The patient was referred to the author for roentgen examination. In the absence of any trauma in the history he assumes an asymptomatic spondylolysis leading to severe spondylolisthesis with symptoms due to compression of the nerve roots. Reabsorption of the compressing osseous structures possibly prevented permanent injury to the nerves. Two roentgenograms are reproduced. The anteroposterior view shows the second lumbar vertebra at the level of the iliac crests and a dense mass corresponding to the lower three lumbar vertebrae superimposed on the sacrum. The rounded inferior border of the mass, representing the anterior superior border of L-5 is seen about in line with the lower end of the sacroiliac joints. In the lateral view, a complete luxation of the spinal column with overriding of L-5 anterior to the sacrum is demonstrated. There appears to be an osseous union between this last lumbar vertebra and the mid sacrum. The upper surface of the sacral bone corresponds to the step which could be palpated under the skin.

H. F. PLAUT, M.D.
Dayton, Ohio

Calcifications of the Intervertebral Discs and the Relationship Between Various Types of Calcifications in the Soft Tissues of the Body. Carl Sandström. Acta radiol. **36:** 217–233, September 1951.

The author discusses the old classification of calcification in the soft tissues and suggests a new grouping, with two main headings, *permanent* and *impermanent*. Calcifications of the intervertebral disks are included in both groups. In the peripheral parts, that is, within the cartilaginous plates and the annulus fibrosus, the calcifications are of the permanent type. In the central part of the disks, that is, in the nucleus pulposus and the adjoining part of the annulus fibrosus, calcification may be either permanent or impermanent.

The determination of impermanent calcifications in a disk, as elsewhere in the body, points to toxic doses of vitamin D or myotendinitis calcarea as a causative factor. Hence such calcifications reveal a certain disease condition, and are of differential diagnostic significance. As far as is known at present, permanent calcifications, or at least those situated within the intervertebral plates, are without clinical significance.

To determine whether a calcification is located centrally or peripherally, roentgenograms should be taken in two planes at right angles to one another, with the central ray over the disk in question.

Three cases are reported: 2 of impermanent calcifications due to myotendinitis calcarea, and 1 of permanent calcification.

Ten roentgenograms; 2 photomicrographs.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Spastic Paraplegia in Late Adult Life, with Degeneration and Protrusion of Cervical Discs. John D. Spillane and Geoffrey H. T. Lloyd. Lancet **2:** 653–657, Oct. 13, 1951.

Observations on 12 cases of spastic paraplegia or tetraplegia developing in late adult life are reported and detailed histories of 3 of these are presented. The duration of symptoms ranged from four months to five years. In 5 cases there was advanced atrophy with fibrillation of the muscles of the shoulders and upper limbs. Superficial sensation was usually unaffected, but in the lower limbs there was often some loss of vibration sense and of joint-position sense in the toes. There was no dissociated sensory impairment. Neck movements were usually normal and painless.

In all patients there was unmistakable roentgenologic evidence of disease of the cervical vertebrae. In the anteroposterior views arthritic changes in the neurocentral joints were often disclosed. Lateral views showed alteration of the normal cervical lordotic curve, narrowing of disk spaces, and osteophytosis of the anterior and posterior vertebral margins. Occasionally subluxation of a vertebra was found. In the oblique views the manner in which osteophytes from the neurocentral joints encroached on the intervertebral foramina was clearly demonstrated. This was a constant finding. These abnormalities occurred most commonly in the lower cervical vertebrae, C5-C7 being specially affected. In 3 cases the changes involved the greater part of the cervical spine. In 2 cases the lesions appeared to be confined to the level of a single disk.

The myelographic findings were abnormal in 11 cases. A delay, often of several minutes, in the flow of the contrast medium (Myodil) in the cervical region was observed on fluoroscopy with the patient's head tilted downward 70° from the horizontal. Films in 11 of the 12 cases revealed one or more transverse breaks in the Myodil column opposite the affected disk spaces, indicating a general protrusion of disk material into the spinal canal anteriorly. Lateral views confirmed these findings.

The authors conclude that multiple cervical disk degeneration may lead to bulging of the disks as a whole into the spinal canal. The ridges thus formed compress the spinal cord, producing symptoms resembling those of common degenerative affections of the cord.

Seven roentgenograms.

Dangers and Errors of Myelography in Herniation of the Intervertebral Disks. U. Ritter. Fortschr. a. d. Geb. d. Röntgenstrahlen. **75:** 339–345, September 1951. (In German)

The author questions the value of myelography in the diagnosis of disk herniation and feels that clinical diagnosis, based largely on the localizing neurological signs, is usually sufficient. The x-ray findings may lead to false impressions and occasionally to a wrong operative approach. No ideally satisfactory contrast medium has been found to date; those in present use may cause irritation (aseptic meningitis) and other untoward results.

At operation the author has found remote pathological changes not demonstrated on the roentgenogram, including vascular tumors, varicosities, arachnoiditis, neurofibroma, hypertrophy of the ligamentum flavum, etc. Thus, in the atypical case he considers the x-ray impression extremely confusing and in many cases actually misleading.

Negative myelograms were obtained in cases with positive operative findings and in a number of cases the apparent myelographic evidence of disk herniation was proved entirely wrong at operation. Twelve operative cases are cited, in only 5 of which were the

radiographic and surgical findings in agreement. In 4 the myelograms did not give informative data, and in 3 they led to wrong conclusions. Errors were especially frequent at the lumbosacral level.

Three roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Radiologic Study of Intraspinal Angioma. Guido Lombardi. Radiol. med. (Milan) **37:** 716–724, September 1951. (In Italian)

The author reports five cases of intraspinal hemangioma demonstrated by myelography and discusses the differential diagnosis between hemangiomas and multiple neurofibromatosis.

Eight roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Roentgenographic Features of Slipped Capital Femoral Epiphysis. Armin Klein, Robert J. Joplin, John A. Reidy, and Joseph Hanelin. Am. J. Roentgenol. **66:** 361–373, September 1951.

The diagnosis of slipped capital femoral epiphysis ultimately is made roentgenographically. For comparison standards, the authors have compiled a series of roentgenograms of normal hips from birth to maturity. Ten features of normal relationships and development are described.

For x-ray examination, two 14 × 17-inch films are used, transversely placed; one exposure is made with the femora in anteroposterior position and one with the hips in the "frog-leg" position.

Slipping is indicated if in the anteroposterior view the head and neck do not describe a continuous arc medially, if the superior neck line fails to transect the head properly or if, in the lateral projection, the head and the adjoining wide part of the neck do not assume a spherical contour. Slipping may be posterior, seen early only in the lateral view, or medial, seen early in the anteroposterior view. Both views are necessary for early diagnosis. With progression, both posterior and medial displacement occur.

Associated changes are widening and irregularity of the epiphyseal plate, periosteal reaction at the medial juxta-epiphyseal portion of the neck ("crow's beak"), and straightening with subsequent convexity of the concave superior and anterior portions of the proximal neck. With marked slipping a shortened and broadened femoral neck results. The authors did not see and doubt the existence of a pre-slip stage.

Treatment depends upon the degree of slipping. If it is minimal, *i.e.*, 1 cm. or less, nailing *in situ* is the accepted treatment; if slipping is marked (over 1 cm.) osteotomy and replacement of the head are necessary before nailing. Nailing insures against further slipping and hastens epiphyseal fusion.

Periodic re-examinations (both hips) are necessary until both femoral capital epiphyses are fused.

One hundred and seven roentgenograms; 11 drawings. LAWRENCE A. PILLA, M.D.
University of Louisville

Acute Plasma Leukemia Without Localized Bone Lesions. Report of a Case with Autopsy Observations. S. H. Lawrence and Harry C. Fortner. Arch. Path. **52:** 384–389, October 1951.

Plasma-cell leukemia without circumscribed bone lesions has only rarely been described. A case is presented which is of particular interest because postmortem examination, including x-ray studies of the skull, long bones, and pelvis, revealed no bone defects, although the marrow was replaced by diffuse plasma-cell infiltrate. Hemorrhage was a prominent feature in the patient's clinical history and was ultimately the complaint which brought him to the hospital. In addition to hemorrhage involving the central nervous system, which caused his death, the patient had epistaxes, as well as petechiae of the skin and mucous membranes.

Four photomicrographs.

Effect of Hypervitaminosis A and Hypovitaminosis A on the Skeleton of a Duck. R. H. Rigdon, J. C. Rude, and J. G. Bieri. Arch. Path. **52:** 299–314, October 1951.

The effects of hypovitaminosis and hypervitaminosis A were studied in 300 ducks. Birds failed to gain normally on a diet deficient in vitamin A and also on a standard diet supplemented with a large amount of vitamin A. Ducks on the latter ration showed a diminution in the amount of pigmentation of the skin of the feet and legs. A decrease was found in the amount of carotene in the serum of ducks receiving 100,000 units of vitamin A as compared with those fed 25,000 units. No significant pathologic or roentgenographic changes were observed in the bones of the extremities of ducks receiving either the deficient ration supplemented with vitamin A or a standard ration supplemented with large amounts of vitamin A. From these experimental studies it is concluded that the effects of hypovitaminosis and hypervitaminosis A in the duck are different from those observed in the rat, the guinea-pig, and the dog.

Nine roentgenograms; 12 photomicrographs; 1 chart; 2 tables.

GYNECOLOGY AND OBSTETRICS

The Tubal Factor in Female Sterility. G. D. Matthew. Edinburgh M. J. **58:** 153–169, April 1951.

From the inception of the "Sterility" Clinic within the Royal Infirmary (Edinburgh) in 1946 to the time of this report, 600 patients had attended, of whom 400 were investigated by tubal insufflation on 540 separate occasions. One hundred and ten patients were examined roentgenologically, and 36 were subjected to laparotomy. Twelve per cent of the patients fully investigated, with findings confirmed, showed tubal occlusion and a further 21 per cent showed evidence of disordered function.

The author reviews the advantages and disadvantages of insufflation and hysterosalpingography in the investigation of tubal function in female sterility and describes his technic for each procedure. He believes that the case in favor of gas insufflation is much the stronger, for from this test not only is clear evidence of tubal patency obtained, but also an accurate and precise picture of tubal activity. Patency is readily demonstrated by hysterosalpingography but, even with the help of fluoroscopy, only crude evidence of tubal activity can be expected. The position and distribution of pain during insufflation may indicate roughly the site of occlusion, but only x-ray examination can definitely establish this point. With the exception of embolism, the nature of the risks attached to each

procedure is essentially the same, with a slightly higher incidence of complications in hysterosalpingography. The possibility of embolism in gas insufflation has been practically eliminated by the use of carbon dioxide.

The author believes tubal insufflation should be done routinely, and should be repeated on two or more occasions if abnormality is discovered. In cases in which tubal occlusion is confirmed, an x-ray examination should be made for the specific purpose of determining the actual site of blockage in order that operative treatment may be considered.

Eight roentgenograms; 26 kymographic tracings.

THE GENITO-URINARY SYSTEM

X-Ray Findings in Adult Urological Conditions. Paul R. Dirkse. Illinois M. J. **100:** 183–187, September 1951.

This concise article describes for those unfamiliar with urographic procedures the various diseases, anomalies, and injuries of the genito-urinary system that can be examined with scout films and pyelography.

Five roentgenograms.

LAWRENCE A. DAVIS, M.D.
University of Louisville

Presacral Perirenal Pneumography. James Blackwood. Brit. J. Surg. **39:** 111–119, September 1951.

The author recommends a method of presacral perirenal air insufflation which appears to be considerably less formidable than the traditional method. The needle is introduced 0.5 cm. anterior to the tip of the coccyx in the midline and is gradually inserted until its tip is located in the presacral hollow just in front of the sacrum and in back of the rectum. With the patient lying on one side, 400 c.c. of air is injected; he is then turned to the other side, and another 400 c.c. is introduced. The patient then walks about for twenty minutes, after which he is examined by intravenous pyelography. Anteroposterior, right oblique, and left oblique films are taken.

The author obtained a very adequate visualization of the perirenal structures. He suggests that the name "presacral perirenal pneumography" be given to this procedure. Illustrative cases, demonstrating the value of the technic, are presented. The method has been used in 15 patients with no untoward results. Injected air is usually absorbed after ten days.

Fifteen roentgenograms; 3 photographs.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Renal Anacidogenesis. Knud Lundbæk. Lancet **2:** 419–422, Sept. 8, 1951.

In recent years Albright and others have reported about 10 cases of a peculiar syndrome consisting of acidosis, hyperchloremia, decalcification of the skeleton accompanied by Milkman fractures, and nephrocalcinosis. A similar and perhaps identical clinical picture in infants has also been described. The syndrome seems to be due to impairment of the capability of the renal tubules to produce acid, and the author therefore thinks the term "renal anacidogenesis" appropriate. He presents a case in a 38-year-old laborer which was characterized by the contrast between the severe acidosis of the blood and the neutral reaction of the urine. The blood chemistry returned to normal after the administration of sodium citrate. After six months treatment with vitamin D_2 and sodium citrate, roentgen examination showed healing of the spontaneous fractures. After eighteen months there was a small but definite decrease of the renal calcification.

Four roentgenograms; 1 photomicrograph; 2 charts.

Medial Deviation of the Ureters Complicating Carcinoma of Rectum and Sigmoid, and Proctosigmoidectomy. Richard J. Spillane, Thomas F. Kaiser, and George C. Prather. Surg. Gynec. & Obst. **93:** 273–282, September 1951.

The authors call attention to the significance of medial deviation of the ureters at the level of the mid sacrum or promontory as demonstrated by intravenous urography in patients who have undergone proctosigmoidectomy.

The mechanisms producing this deviation are thought to be the following: (1) pressure on the ureters from carcinomatous invasion of the pelvis with involvement of the iliac lymph nodes; (2) tension on the ureters produced in the course of peritonealizing the pelvic floor where adequate pelvic peritoneal flaps have not been developed in the course of proctosigmoidectomy. The authors suggest that in the former case, the deformity be termed "medial fixation" of the ureters, and in the latter, "medial deviation."

Serious upper urinary tract complications may result from the distortion of the course of the ureters, the obstruction leading to oliguria, anuria, uremia, and death from massive hydronephrosis. Nephrostomy, though unsatisfactory, is the treatment of choice.

The authors stress the necessity for reconstruction of the pelvic floor without tension on the ureters and recommend that preoperative and postoperative intravenous urography be performed in all cases of lower bowel carcinoma coming to surgery, to provide base ine data relative to the urinary tract.

Nine cases are presented.

Sixteen roentgenograms; 1 photomicrograph; 1 table.

WILLIAM TUDDENHAM, M.D.
University of Pennsylvania

Urethrocystographic Studies of Nervous Disturbances of the Urinary Bladder and the Urethra. A Preliminary Report. G. Giertz and K. Lindblom. Acta radiol. **36:** 205–216, September 1951.

The authors report urethrocystographic studies in 79 cases of nervous disturbances of the urinary bladder and urethra. They demonstrated that the level of the nervous lesion has a definite influence on the type of urethrocystographic change. Four types of urethrocystographic appearances in nervous lesions may be differentiated:

(1) The supranuclear type which includes cerebral lesions and spinal lesions above the bladder center, characterized by a permanently round bladder of moderate capacity, with a decreased tendency to opening of the bladder neck and no change in shape during voiding.

(2) The infranuclear type which includes spinal lesions below the bladder center, mainly lesions of the cauda equina. The bladder is of "pine-tree" shape, with a "funnel urethra" terminating with a marked narrowing of the lumen at the level of the external sphincter. The bladder is permanently raised and in

most instances markedly trabeculated, with small diverticula.

(3) The enuresis type, appearing normal during retrograde filling, but with an increased tendency to empty.

(4) The atonic type, characterized by a large hypotonic bladder which appears normal during retrograde filling but shows little tendency to empty.

Schematic illustrations as well as roentgenograms are presented to demonstrate each of these types. It is brought out that the fourth or atonic type is not caused by a lesion of the central nervous system, being most often a complication of pregnancy or abdominal surgery.

The authors' conclusion is that urethrocystographic studies during retrograde injection and micturition are a valuable help in the study of nervous disturbances in the bladder and urethra.

Eighteen roentgenograms; 2 drawings.

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Vesical Evidence of Posterolateral Spinal Cord Disease. Robert Lich, Jr., and Joseph E. Maurer. J. Urol. **66**: 213–217, August 1951.

Two cases of acute posterolateral spinal cord disease are described and a short general discussion of radiographic, cystoscopic, and clinical findings in this condition is given.

The "straight line vesical defect," consisting of a sharply cut off lower margin of the vesical neck seen on cystograms, has been found by the authors over a period of several years to be uniformly associated with posterolateral spinal cord disease rather than vesical atonia *per se*. It was found in posterior lateral spinal cord disease of a variety of etiologies including pernicious anemia, tabes dorsalis and syringomyelia. The two reported cases are examples of post rabies vaccine myelitis and allergic myelitis following tetanus antitoxin.

The "straight line defect" is attributed to hypertrophy and elevation of the interureteric ridge. It is well demonstrated only when the bladder is not fully distended on cystography. The defect was present only in patients with residual urine, and cystometrograms in all cases in which they were done showed typical and marked atonic curves. Associated findings include approximation of the ureteral orifices with a marked bowing of the interureteric ridge and a resultant diminution of the trigonal altitude. The vesical neck is reduced in caliber due to a thickening of the tissues and there appears a concavity of the posterior urethra between the verumontanum and vesical neck with an apparent shortening of the posterior urethra.

One roentgenogram.

ADELE L. KYNETTE, M.D.
University of Pennsylvania

Extra-urethral Confines of Urethrographic Contrast Medium. Anthony R. Fernicola. J. Urol. **66**: 132–144, July 1951.

The pathogenesis of extra-urethral invasion of urethrographic contrast material involves several important factors, namely, the integrity of the urethra, the vascularity of the urethral confines, the nature of the contrast medium used relative to oily content and viscosity, the quantity of medium delivered to extraneous foci, the rate of injection, and the degree of pressure utilized during the procedure.

The purpose of this study was to correlate some of the varieties of extra-urethral configurations of contrast medium with urethral disease entities and to determine the relative influence of various factors instrumental in the production of extravasation or intravasation. Two hundred urethrograms were done on males with a variety of demonstrated or suspected lower urinary tract diseases.

The significant observations in this study were the high percentage of invasion of extra-urethral anatomical confines; the absence of untoward effects; the fact that urethrographic contrast medium was not extravasated from the normal urethra in the presence of excessive pressure; the fact that extensive venous invasion, present in four instances, occurred in the absence of excessive pressure or hematuria.

Venous invasion occasions greatest concern, particularly when an oily medium is used. The dye enters the venous channels in the region of the anterior and posterior urethra and follows the branches of either the internal pudendal or inferior vesical veins, all of which empty into the hypogastric veins. The common iliac veins and inferior vena cava then provide pathways for the mechanism of pulmonary embolism or, less often, coronary, cerebral, or general visceral embolism. Urethral disease was found to be a prerequisite for the production of extra-urethral invasion of the dye. That the effect of pressure or the rate of injection or the quantity of the medium used can determine the final disposition of extravasated dye is plausible, but none of these factors is a required element in the pathogenesis of extravasation.

The effect of pressure is important, but it has been demonstrated that excessive pressure will not produce extravasation in a normal urethra.

The factor of vascularity is most important during erection of the penis. The congestion of the penile veins undoubtedly produces a local increase in venous pressure, which enhances the degree of intravascular invasion of the medium.

The significant effect of the viscosity of the medium concerns the rate at which the medium travels through the venous system. Under any circumstances, the property of viscosity is presumably that of retarding the progression of the contrast medium and attenuating the production of fatal pulmonary oil embolism.

In an analysis of the amount of dye used, it would seem that not much more than 1.0 c.c. gains entry into the circulation. Therefore, the quantity delivered to the lungs per unit time would appear to be more significant than the amount introduced into the circulation.

Following the discussions of the above named factors, the author describes various urethrographic configurations of the impaired urethral wall. He also discusses the relationship of hematuria and intravasation.

Twelve roentgenograms; 1 table.

NELSON E. KLAMM, M.D.
Cleveland City Hospital

THE SPLEEN

Calcifications in the Spleen. W. Hirsch. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 179–186, August 1951. (In German)

The author discusses the calcifications that occur

within the spleen, with a thorough review of the literature and five case reports of his own.

Calcifications of the spleen may be subdivided into those of the capsule and those of the parenchyma. The calcifications of the capsule are either traumatic or due to inflammation (perisplenitis). They may assume quite large dimensions and may cover a large portion of the surface of the spleen. Of the calcifications within the spleen itself, two types are particularly noteworthy, as they occur more frequently than all the others. They are phleboliths and calcifications due to tuberculosis. Those due to tuberculosis generally are minute calcified bodies with a polyhedral outline. They are arranged in groups or may occur singly. Often they show an increased density within the center which may be due to calcified central caseation. Phleboliths are usually a little larger, ranging in size from that of a small lentil up to a small bean. They are sharply defined and present a rather intense shadow. They also, may occur either singly or in groups, but they show a concentric structure with onion-peel-like rings and the central zone often shows a diminution of lime content. These characteristics of the two groups, however, should be considered only as a guide to diagnosis. The deciding factor is the clinical findings, including the case history. In the case of tuberculosis, evidences of the disease elsewhere can usually be demonstrated.

The other types of calcifications of the spleen are rather rare. Calcified cysts due to the echinococcus may reach several centimeters in diameter. Calcifications also occur as a result of localized necrosis, due to abscesses or infarcts, in which case they assume a variable shape. Syphilis (gumma), cavernous angiomata, and various parasites may be responsible for calcifications, or they may represent incrustations in the vessels of the spleen.

Seven roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Preliminary Results in Direct Visualization of the Spleen. Mauro Malventi. Radiol. med. (Milan) **37:** 758–771, September 1951. (In Italian)

The various methods of visualization of the spleen are discussed, with their advantages and their disadvantages. The author reports a series of experiments during which he injected Ioduron directly into the spleen of rabbits. The spleen was very well visualized, and the opacity persisted from thirty to sixty minutes. Histologic study at twelve, twenty-four, and forty-eight hours following the injection of the dye showed no essential change from the normal.

Twenty-five roentgenograms; 1 photograph; 1 photomicrograph. CESARE GIANTURCO, M.D.
Urbana, Ill.

THE BLOOD VESSELS

Arteriography. Joseph M. Janes. Am. Practitioner **2:** 569–573, July 1951.

The author employs a 35 per cent solution of Diodrast, injecting it into the artery under direct vision. The procedure is carried out in the operating room and the technics for the upper and lower extremities are described in detail.

In Raynaud's disease, the two common findings are absence of filling of the distal parts of the digital arteries and diminution in the caliber of these arteries in the distal portions.

In thromboangiitis obliterans, there is a shaggy outline or mottling of the shadow of the involved vessel or vessels. As the disease progresses, the caliber of the artery is gradually diminished until complete occlusion occurs. The presence of collateral circulation is evidence of primary arterial disease, and the size and extent of the collateral vessels may be important factors in prognosis. In cases of arteriosclerosis obliterans when gangrene is present, arteriography may be used to determine the optimum site of amputation.

In arterial spasm, arteriography may be employed, although there is some reluctance to use Diodrast for fear of intensifying the spasm.

In aneurysms of the extremities, arteriography finds a most important role. It locates the aneurysm, gives an idea as to its size, and shows the extent of the collateral circulation.

In arteriovenous fistula, arteriography indicates the site of the fistula and the extent of the collateral circulation.

There are other fields in which arteriography may be of value. The first of these is tumors of bone. Fariñas in 1937 stated that it is possible to recognize various tumors according to their arteriographic images. When tumors are benign, the blood vessels are displaced but are regular in caliber and not increased in number. Giant-cell tumors do not exhibit an intratumoral circulation, but an artery which follows around the capsule can be demonstrated. Malignant tumors reveal numerous vascular pedicles and an irregular network of newly formed vessels of the same caliber.

It has been said that arteriovenous fistulas may be present in Paget's disease.

Reference is made to the use of arteriography in certain experimental and investigative work. No untoward effects have been noted to date.

Six roentgenograms; 3 photographs.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Experiences and Observations in 400 Arteriographic Studies. J. Weis. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 145–159, August 1951. (In German)

Arteriography is, perhaps, the most valuable diagnostic procedure in the various peripheral vascular disturbances. The rather limited use of this method is probably due to the lack of mastery of the technic and of experience in interpreting the films. The writer has worked out a very satisfactory method, and has gained considerable experience in 400 arteriographic studies. The contrast medium mostly used in recent years is Perabrodil, which is obtainable in 35 per cent, 45 per cent, 60 per cent, and 80 per cent solutions. The 80 per cent solution is used for the arteriography of the aorta, and the less concentrated solutions for the extremities.

The procedure requires rapid and well organized teamwork. The injection can be made by percutaneous puncture of the vein or after surgical exposure of the artery through a small incision. The direct puncture through the skin requires experience but is much to be preferred. The site is anesthetized with novocaine (but without adrenalin), and the needle is thrust through the skin. The artery is felt and identified between two fingers of the left hand, while the right hand pushes the needle through the vessel wall. The needle

is then connected with a rubber hose to the syringe, and the barrel of the syringe, in turn, is hooked up with a pressure tank, which permits of careful regulation. Ordinarily, the injection is made with a fixed pressure of two atmospheres. The x-ray exposures are made without the use of a cassette changer, although the writer admits that this would be valuable.

For the visualization of the vessels of the lower extremities, the injection is made into the femoral artery, just below Poupart's ligament, where the artery can be plainly felt. From 20 to 40 c.c. of the contrast medium is injected, and exposures of the entire length of the lower leg are made on two 14 × 17-inch films as soon as 20 c.c. of the dye has been injected. Additional exposures are made as quickly as the cassettes can be changed. The exact time interval between the injection of the dye and the making of the exposure is carefully measured with a stop watch and registered. In that way, the speed of the circulation can be easily determined by simple arithmetic.

For the visualization of the lower or upper arm, the injection is made either into the brachial artery or into the subclavian artery just below the collar bone. This injection is one of the most difficult, and great care must be taken not to injure the nerves near the vessels. If any doubt exists, surgical exposure of the artery is to be preferred.

For injection of the abdominal aorta, the patient is placed in a prone position. A needle 1 1/2 mm. wide and 15 cm. long is used, and the injection is made between the eleventh and twelfth ribs or just below the twelfth rib, about one and one-half hand's breadth laterally from the medial plane. A 10 c.c. syringe is used for the introduction of the needle, which is inserted at an angle of 50° between two transverse processes, and is pushed forward until it strikes the anterior edges of a vertebral body. It is then carefully directed anteriorly until it pierces the aorta and bright red blood enters the syringe. For this injection 40 c.c. of the 80 per cent Perabrodil is used and the pressure of the gas tank is between 2 1/2 and 3 atmospheres. Severe hemorrhages have never been observed. The patient is made to walk around immediately after the procedure, as this produces contraction of the psoas muscle and minimizes the chance of formation of a hematoma.

The writer has been able to gain important information about injuries and pathologic processes in the large vessels which has been of inestimable value in determining the operative procedure for their correction A repeat examination after the operation makes it possible to evaluate the results of the operation. Arteriography has also been helpful in the differential diagnosis of various diseases of the blood vessels. Important criteria have been established for the differential diagnosis between arteriosclerosis, Buerger's disease, and Raynaud's disease. However, a great deal of work has still to be done in this respect, as differentiation is not easy, particularly in advanced cases, where the diagnostic criteria overlap.

Tortuosity of collateral vessels is not characteristic of any special disease, but is, in the opinion of the writer, an expression of some resistance in the circulatory system distal to the tortuosity.

The ability of the system to make up for an occlusion of a vessel by means of a collateral circulation depends upon the rapidity with which the occlusion has occurred and upon the age of the patient. Apparently, the closer to the heart the occlusion has occurred, the better is the ability to establish a collateral circulation. For instance, in occlusion of the iliac vessels, an abundant collateral circulation has been demonstrated in the pelvis, but if the popliteal artery is occluded, the collateral circulation in the lower leg is notoriously insufficient.

One more observation which the writer describes in detail is the occurrence of arteriovenous anastomoses proximal to the capillary bed. These anastomoses are in full operation if there is an obstruction in the capillary or precapillary circulation, and they divert a great deal of blood directly into the venous system, thus acting as a safety valve. The anastomoses are preformed but almost closed if the peripheral circulation is normal.

The illustrations are excellent, the text is written in a most interesting manner, many of the ideas are original, and several case records are given in detail. This article should be read in the original by any reader who is interested in arteriography.

Twenty roentgenograms; 2 tables.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Arteriography as Observed in 80 Patients at St. Louis City Hospital. Grady Watterson Reagan, Jr., and Grayson Carroll. J. Urol. **66:** 467–473, September 1951.

Experiences with renal arteriography in 80 patients at St. Louis City Hospital are presented: 15 c.c. of 80 per cent sodium iodide was injected under general anesthesia into the aorta at the level of the twelfth thoracic vertebra, entering the vessel from its posterior lateral aspect, with a 17 gauge needle 6 1/2 inches long. The needle was ground with an eighth-inch bevel to minimize the danger of hemorrhage and extravasation. Injections in most cases are carried out by hand pressure, using an ordinary glass syringe. Special rapid injection devices used in earlier patients were found unnecessary, since uniformly satisfactory results could be obtained by the simpler hand method. Radiographic procedure is not discussed.

No serious complications were encountered. In two cases, extra-aortic injection of the contrast medium occurred, and this was followed only by pain over the injection site lasting three or four days. In a third case there was partial injection of the superior mesenteric artery, but no morbidity followed.

The procedure finds its chief value in differentiating between various renal and other retroperitoneal mass lesions, in preoperative determination of the arterial distribution to the kidney, in the demonstration of renal vein involvement in hypernephroma, and in the diagnosis of aneurysms. It should not be used unless simpler methods fail to supply the desired information.

Renal arteriography is considered relatively safe if done in a careful manner and with proper attention to detail. It should not be done in patients with tuberculosis or thyroid disease, nor in patients with markedly impaired renal function, especially when this is associated with malignant hypertension. No ill effects were observed in this series in elderly arteriosclerotic patients. Testing for iodine sensitivity should be carried out prior to the injection.

Nineteen roentgenograms.

W. C. OWSLEY, JR., M.D.
University of Pennsylvania

Evaluation of the Mesenchyma in Malignant Processes, with Consideration of the Arteriographic Findings. R. Pape and R. Seyss. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 138–144, August 1951.

The mesenchyma, with its cells and fibers, its nerves and blood vessels, is an essential part of every malignant tumor. It serves as a matrix and as stroma to the tumor. While the circulation in normal tissues or in inflamed tissues can be definitely divided into arteries, capillaries, and veins, such a differentiation is not possible in the mesenchyma of malignant tumors. There one sees only irregular wide and narrow blood spaces or blood channels.

The authors describe their arteriographic findings in 2 cases of proved malignant tumor, a metastatic carcinoma of the radius and a Ewing's sarcoma of the ulna. Films were taken before and at intervals of five seconds following the injection of a radiopaque dye.

In the case of the carcinoma, the film taken before the injection of the dye shows a defect in the bone corresponding to the extent of the malignant lesion, but it does not reveal the extent of involvement of the soft tissues. In the films taken after injection a blurry contrast shadow occupies the area of the defect, with an indistinct network and cloud-like accumulation of denser material. The tumor itself is fairly sharply defined, and its extension into the soft tissues is clearly demonstrable. The intensity of contrast increases toward the marginal portions of the neoplasm. The retention of the contrast medium within the tumor is definitely prolonged; it is still noticeable two minutes after the injection. Histologic examination in this case, following operation, showed a rich fibrillary hyalinized connective tissue with very wide blood spaces lined with simple endothelium and filled with cancer cells.

In contradistinction, arteriography in chronic osteomyelitis shows a rather normal circulatory system. The vessels may be slightly dilated, but in an orderly fashion, and the blurry dye accumulation within the lesion cannot be noticed.

The authors point out that arteriography is of value in making a differential diagnosis between a benign inflammatory lesion and a malignant tumor. Furthermore, it gives information about the extent of the tumor into the soft tissues. After operation, arteriography may give valuable information regarding a recurrence.

The writers briefly mention certain recent histologic findings in relation to neuro-hormonal and allergic manifestations in patients with cancer.

Five roentgenograms; 3 photomicrographs.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Translumbar Serial Aortography: A New Medium and a New Technique. W. F. Melick, C. P. Yarbrough and T. D. Boler. J. Urol. **66:** 458–466, September 1951.

Translumbar aortography is now becoming a more widely accepted procedure, in spite of the fact that there is still not a completely safe contrast medium available. The medium which has been used in the past, 80 per cent sodium iodide, has led to several fatalities (known to the authors through personal communications), the cause of death in each instance being necrosis of the bowel resultant upon the accidental injection of the iodide into the superior mesenteric artery instead of the aorta. The medium which would be ideal would be one of low viscosity, low toxicity, extreme x-ray density, and non-irritation in the concentration required.

The authors used Neo-iopax in 75 per cent concentration because it is easily injected, has a low viscosity, and is far less irritating than 80 per cent sodium iodide. In routine translumbar aortography it gives almost as good results clinically as the iodide, though not quite so good for purposes of film reproduction, and to date no harmful effects have been noted following extravasation. (The authors point out that they have been fortunate in not injecting the superior mesenteric artery with either Neo-iopax or sodium iodide.)

Another disadvantage of aortography, along with that of the problem of suitable contrast medium, has been that of the limitation of pictures, one being made during injection, and a second one made just after the injection. The authors were thus stimulated to work out a practical method of obtaining serial films, which would demonstrate dye flowing into and out of the kidney. They mention two such devices, one of which will shortly be available commercially.

The clinical application of serial aortography is illustrated in the case of a patient who had a renal artery embolus, and films are reproduced, along with diagrams, to show this phenomenon. In a second case a space-taking lesion of the renal parenchyma is demonstrated by serial films. In these latter films the complete renal circulation is shown, and it is believed that this is the first time this has been demonstrated in man by the translumbar route.

Sixteen roentgenograms.

LOIS I. KING, M.D.
University of Pennsylvania

Interpretation of Translumbar Arteriograms. Parke G. Smith, T. W. Rush, and Arthur T. Evans. J. Urol. **66:** 145–152, July 1951.

The importance of a complete knowledge of the anatomy of the abdominal aorta and its branches for accurate interpretation of translumbar arteriograms is emphasized. After a concise description of the normal renal arteriogram, the following conditions are discussed.

1. *Bifurcation of the Renal Pelvis:* In this anatomical variant there is a multiplicity of renal arteries.

2. *Congenital Ectopic Kidney:* Arteriograms in such cases have demonstrated associated anomalous vessels in a high percentage of patients. In addition, the arterial supply frequently arises not only from the normal position in the aorta, but also from the common iliac artery and from pelvic vessels on the opposite side.

3. *Crossed Renal Ectopia:* The renal vessels are variable in number and point of origin.

4. *Horseshoe Kidney:* This anomaly is characterized by a great variation in the distribution of the renal arteries.

5. *Hypoplastic Kidney:* As would be expected, there is a very small artery with few branches and a lack of typical "fanning out." Arteriography is important in that it is the only method that will determine if there is a remnant of kidney present in the renal fossa.

6. *Renal Hypertension:* Hypertension on the basis of unilateral kidney disease is discussed. More specifically, compression of the renal vein with subsequent surgery and disappearance of the hypertension is described. Arteriography aids in determining the kidney disease or abnormality.

7. *Renal Infarction:* There is a very characteristic sudden termination of arteries in the region of infarcts, with an area of avascularity between their termination and the renal capsule.

8. *Hydronephrosis:* Arteriography is informative in determining the presence or absence of an aberrant artery which may be the cause of the hydronephrosis. The vascular pattern within the kidney shows an absence of normal "fanning out" of terminal branches.

9. *Ureteral Obstruction:* Arteriography is of importance in determining the adequacy of the arterial supply. Removal of the kidney may be indicated if the arterial supply is diminished.

10. *Renal Tumors:* Arteriography shows "pooling" of the contrast medium in the area of the lesion indicated by pyelography. There may also be noted irregularity of the vessels within the tumor, but this is not a constant finding. Tumors arising from the renal pelvis and invading the renal parenchyma may show a slight change in the vascular pattern but seldom demonstrate a tendency to "pooling."

11. *Solitary Renal Cyst:* A comparatively avascular area is noted in the region of the filling defect, as shown on the pyelogram. In some cases, there may be a definite curving of the vessels around the avascular area.

12. *Polycystic Kidney:* There is a spreading out of the entire pattern with a tendency toward disappearance of the terminal branches, producing areas of avascularity.

Seven illustrations, including one roentgenogram.

NORMAN GLAZER, M.D.
Cleveland City Hospital

Aortography and Renal Arteriography Following Percutaneous Retrograde Catheterization of the Femoral Artery and Aorta. Benjamin S. Abeshouse, I. Scherlis, M. Golden, and M. Rubin. Urol. & Cutan. Rev. **55**: 517–528, September 1951.

The authors give a brief historical review of aortography and the various methods of accomplishing it. They used percutaneous catheterization of the unexposed femoral artery with polyethylene catheters. Accurate placement of the catheter at the desired level is determined by the injection of a small amount of the dye and the rapid exposure of a film. Twenty cubic centimeters of 70 per cent Diodrast is commonly used. The technical methods are described in detail.

Complications have been mild. In one case the catheter broke and had to be operatively removed. Hematoma, bleeding, or thrombosis are possible complications, but all are rare.

As compared to other methods of aortography the percutaneous retrograde procedure is simple and allows an accurate placement of the tip of the catheter. With a superimposed retrograde pyelogram the procedure is particularly useful. The following indications are listed:

1. *Blood Supply of the Kidney:* Good visualization allows for a more accurate surgical approach. Aberrant and anomalous arteries can be seen preoperatively.

2. *Congenital Anomalies of the Kidney:* Determination of the length of a vascular pedicle allows differentiation between congenital ectopic kidneys and nephroptosis. The amount of blood reaching a particular portion of renal tissue makes possible a more accurate and adequate surgical procedure.

3. *Renal Neoplasms:* Solid tumors give a particular vascular pattern. Large tumors may displace or compress the renal arteries.

4. *Renal Cysts:* These are avascular.

5. *Hydronephrosis:* When poor function and obstruction prevent retrograde or intravenous pyelography, renal aortography is the only method of determining the amount of viable tissue left in the kidney.

6. *Hypertension of Renal Origin:* Aortography can determine (*a*) the degree of renal ischemia; (*b*) caliber changes in the renal vessels; (*c*) whether the disease process is bilateral.

7. *Adrenal Tumors:* A dye pattern may be seen in these tumors. Displacement of the kidney will be clearly demonstrated.

8. *Bladder and Prostatic Disease:* These may be investigated by means of retrograde aortography in the future.

9. *Intra-abdominal and Retroperitoneal Tumors:* Displacement of the normal vascular patterns of the kidney, stomach, or intestines may aid in diagnosing these lesions. Occasionally neoplasms of this nature will show a peculiar vascular tumor pattern.

10. *Diseases of the Aorta and Its Branches:* Translumbar and retrograde aortography are the procedures of choice here.

Ten roentgenograms.

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Post Mortem Arteriography in "Normal" Lower Limbs. C. F. Ross and K. D. Keele. Angiology **2**: 374–385, October 1951.

In order to determine the incidence of arterial occlusion and to investigate the vascular pattern in the lower limbs of patients with no symptoms suggestive of vascular occlusion, 100 lower limbs were studied postmortem. Seventeen of the patients had clinical or pathological evidence of systemic hypertension, but the rest had died of other miscellaneous conditions. Most were in late middle life or older, but about a fourth were under fifty years of age.

The authors describe the apparatus and technic for postmortem arteriography of the lower limbs and recommend that this procedure be made part of general autopsy routine when examining cases of arterial disease. A proprietary brand of barium sulfate cream, diluted with an equal volume of water, was used as a contrast medium. This suspension did not settle out during the arteriography, and under the conditions of the experiment did not pass into the capillaries or beyond. The only difficulty encountered was the presence of postmortem clot. This can often be seen sticking to the side of an artery and is sometimes dislodged by the injection. The clot then acts as an embolus and causes partial or complete blocking of smaller vessels below. Slow initial injection minimizes this risk, but in 12 per cent of the legs and 22 per cent of the feet proper filling of the vessels was not obtained. These clots sometimes form "saddle emboli" across divisions of arteries, as seen occasionally in life.

Antemortem occlusions (all confirmed by dissection) were found in 7 per cent of the limbs. In these cases tortuosity was general and not limited to the regions of collateral circulation, suggesting that it was present before blockage occurred. Similar degrees of tortuosity were found in patients in similar age groups without arterial occlusion. This, in the opinion of the authors,

provides good evidence that with large numbers of tortuous vessels present before occlusion, pre-existing collateral channels are readily available which will carry an adequate supply of blood to the limb distal to an occluded segment. Moreover, the walls of these vessels being rigid, they are not so liable to reflex spasm. In such circumstances, occlusion of a main vessel can occur with a minimum of symptoms.

Twelve illustrations, including 10 roentgenograms; 2 tables.

Dynamic Phlebography. J. Alfredo Ferreira, Eduardo J. F. Villamil, and Augusto O. Ciruzzi. Angiology **2**: 350–373, October 1951.

The various methods for the roentgenologic investigation of the venous system of the legs are compared and the advantages of retrograde phlebography are pointed out. By using the popliteal instead of the femoral route, the authors have been able to study the circulatory dynamics of the venous system of the lower leg and clear up some of the problems encountered in this work.

The authors' technic, based on the examination of 150 cases, is as follows: With the patient prone, the limb to be explored is placed upon the central part of a specially built "cassette changer" in such a manner that the knee is at the level of the union of the upper and middle thirds. With this apparatus, it is possible to obtain within a short interval, and without moving the patient, two pictures on a single film measuring 43 × 35 cm. It consists of a wooden box measuring 55 × 45 cm., containing two lead plates so placed in the lateral thirds as to allow the passage of the x-rays through the middle third only. The first roentgenogram is taken on the left half of the film while the right half is shielded by the lead at one side. The film is then shifted so that the left half is protected and the right half is exposed.

Through a transverse incision about 6 cm. below the popliteal fold, the lesser saphenous vein is exposed. After partial incision of the vein it is catheterized with a plastic tubing which, because of its wider lumen, permits a speedier injection of the contrast medium than a standard catheter. Insertion of the tubing is limited to about 2 cm. Once the vein is canalized, the foot of the table is lowered until an angle of 45 degrees is reached. At this point, with the patient still in prone position, 20 c.c. of Nitasom (a product similar to Diodrast) is injected over a period of ten to fifteen seconds. The first roentgenogram is taken without delay. The patient is then told to contract and relax the muscles of his calf, which is accomplished by raising the heels twice, consecutively. The second roentgenogram is then taken.

So far only the inferior quarter of the femoral vein has been visualized. When further information is desired, ascending phlebography of the femoral vein is incorporated in the examination. This is accomplished by returning the table to a horizontal position and, without moving the catheter, injecting another 20 c.c. of Nitasom. A third roentgenogram is then taken on a film placed in the Potter-Bucky diaphragm below the thigh. In this manner it is possible to demonstrate the femoral vein and even the iliacs. The catheter is then withdrawn, a piece of the vein is excised for histologic examination, and the skin is sutured.

Roentgenograms showing normal and pathologic venous systems are reproduced.

Different Pathways of Pelvic Exploration by Phlebography. J. Ducuing, P. Guilhem, A. Enjalbert, R. Baux, and J. Paillé. J. radiol. et d'électrol. **32**: 713–719, 1951. (In French)

Interest in pelvic phlebography stems from the desire to know more about the anatomy and physiology of the pelvic veins, especially as this might be applied to the study of thrombophlebitis and malignant diseases of this region. Attempts have been made to picture the venous system after arterial injection, analogous to cerebral angiography, but these have not been entirely satisfactory. Injection of contrast medium into the femoral vein results in unilateral filling of large venous trunks. Injection of hemorrhoidal veins gives insufficient information about the pelvic veins, as the contrast substance passes immediately, *via* the superior hemorrhoidal vein, into the portal system (inferior mesenteric). During herniorrhaphy, injection of the vein of the spermatic cord results in opacifying the iliac veins on one side. The most interesting results have been obtained by injecting the dorsal vein of the penis or clitoris, as good filling of both sides of the pelvic venous system is thus obtained.

Regional opacification of pelvic veins has been obtained by transosseous injection in five areas. Injections were made into the greater trochanter, pubic, ischial, and sacral bones, and into the iliac crest.

Several venous currents are described. Among the parietal currents are sacral, ischiogluteal, and obturator. Among the visceral currents are vesical, genital, and rectal. In normal cases the visceral currents are not shown.

Transosseous injection offers several advantages: ease of execution, regional emphasis, large volume injection, and visibility of both hypogastric and external iliac veins.

Ten roentgenograms. CHARLES M. NICE, M.D.
University of Minnesota

Congenital Aneurysmal Dilatation of the Ascending Aorta Associated with Arachnodactyly. An Angiocardiographic Study. S. Schorr, K. Braun, and J. Wildman. Am. Heart J. **42**: 610–616, October 1951.

A case of aneurysmal dilatation of the aorta associated with arachnodactyly is presented. The patient was a 27-year-old woman who had recurrent attacks of fever for four years, which were favorably influenced by antibiotics. Fluoroscopic examination of the chest revealed a markedly enlarged mediastinum with only slight pulsation of the aortic segment. An intravenous angiocardiogram demonstrated a narrow aortic conus. The ascending aorta was markedly dilated. A filling defect was visible along the lateral wall of the descending aorta.

It was assumed that the aneurysmal dilatation of the ascending aorta was the primary site of infection, the bacterial vegetation developing upon the intima of the aorta. The clinical course of this bacterial arteritis was essentially identical with that of subacute bacterial endocarditis.

The case is fairly similar in its clinical features, including the associated arachnodactyly, to one reported by Baer, Taussig, and Oppenheimer (Bull. Johns Hopkins Hosp. **72**: 309, 1943. Abst. in Radiology **42**: 305, 1944).

Five roentgenograms; 1 electrocardiogram; 2 drawings. HOWARD L. STEINBACH, M.D.
University of California

Coarctation of the Aorta. A Study of Seventy Cases in Which Surgical Exploration was Performed. O. Theron Clagett and Robert W. Jampolis. Arch. Surg. **63**: 337–347, September 1951.

A study of 70 cases of coarctation of the aorta is presented, in which surgical exploration was performed. The youngest patient was seven years of age, the oldest fifty. There were 44 males and 26 females.

Individuals with coarctation of the aorta frequently appear normal and healthy, many carrying on daily and even athletic activities unaware of the presence of the defect. Nineteen of the authors' patients were completely asymptomatic, and 23 practically so. In the others easy fatigability and dyspnea on exertion were the most frequent presenting symptoms.

Although the tendency has been to rely more and more on roentgenologic interpretations, a stethoscope, a sphygmomanometer, and one's fingers are all that are needed to make the diagnosis. Hypertension and cardiac murmur in a young person should suggest the possibility of coarctation of the aorta. The roentgen changes are the result of the increased collateral circulation and the added strain on the heart. Since these manifestations may require years for their development, they may not be observed in childhood.

Resection of the strictured segment of aorta with end-to-end anastomosis is the treatment of choice. Of the 70 cases presented, 11.4 per cent were found inoperable at the time of exploration. The operative mortality rate was 7.1 per cent.

Patients with coarctation of the aorta should not be denied the possible benefits of surgery because of advanced age, myocardial conduction defects, previous cerebrovascular accidents, or previous congestive failure.

Two tables.

FRANK T. MORAN, M.D.
Lancaster, Penna.

Transposition of the Aorta and Pulmonary Artery. Maurice Campbell and S. Suzman. Circulation **4**: 329–342, September 1951.

After studying 25 cases of transposition of the great vessels the authors have found a fairly characteristic picture. The two common features are cyanosis plus engorged pulmonary vessels (not only the primary branches) which show expansile pulsation fluoroscopically. The shape of the pulmonary arc may be either concave or convex depending not only upon the dilatation of the pulmonary artery but also upon the variable position of the ascending aorta. In most cases there is general mottling of the lung fields.

Because with transposition of the vessels there must be some interchange between the right and left sides to maintain life for more than a few minutes (since the oxygenated blood is sent from the left ventricle back to the lungs and the peripheral blood from the right ventricle is sent to the aorta), the resulting shunts and the pressure generated by the left ventricle give rise to engorged, pulsating pulmonary vessels.

In 6 patients cardiac catheterization was done, and in 5 of these and 2 others angiocardiographic studies were made. In 3 cases the oxygen saturation of the pulmonary artery was much higher than that of the aorta, proving that, functionally at least, there was transposition; and in the other 3 this diagnosis was supported indirectly. Angiocardiography proved that the aorta arose from the right ventricle in 2, and in one of these in the position normally occupied by the pulmonary artery. In the others the aorta probably overrode both ventricles. In all these there was evidence that the pulmonary artery arose—entirely, mainly, or at least half—from the left ventricle. In 1 of these there may have been a single ventricle. In 2 others the diagnosis was made after the findings at operation.

Two conditions may be confused with transposition of the aorta and pulmonary artery, *i.e.*, Eisenmenger's complex and truncus arteriosus (or its equivalents). In Eisenmenger's complex the cyanosis starts later in life as a rule, and in truncus arteriosus there is an ill defined nodular mass of hilar vessels instead of clear-cut trunks, but angiocardiography will differentiate them if there is any question. It is important to make the diagnosis so that the patient may be spared thoracotomy, since nothing can be done at present.

Two cases are presented in which there was infundibular stenosis complicating transposition and hence the pulmonary vessels were not engorged and pulsating.

This article is definitely recommended to anyone interested in angiocardiography and/or congenital heart disease.

Thirteen roentgenograms; 2 photographs; 4 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Superior Vena Cava and Innominate Veins: Angiocardiographic Study. Douglas J. Roberts, Jr., Charles T. Dotter, and Israel Steinberg. Am. J. Roentgenol. **66**: 341–352, September 1951.

The anatomy of the superior vena cava and innominate veins is outlined and their liability to compression by the important lymph nodes of the region is discussed.

Conventional roentgen examination offers little information concerning the superior vena caval system. Angiocardiographic examination, however, affords excellent visualization, as is demonstrated by reproductions of films showing the normal variations as well as the effects of different intrathoracic pressures upon the diameters of the superior vena cava and innominate veins.

Pathological abnormalities and congenital anomalies, obstruction, displacement, and dilatation are discussed. Many cases of partial vena caval obstruction which would have otherwise escaped recognition were demonstrated on angiocardiograms.

For suspected obstruction 35 to 50 per cent Diodrast, Neo-iopax, or Urokon is used in lesser volumes than are employed in routine angiocardiography. Exposures are made one to two seconds after injection. If the block is complete, accurate timing is not critical. A choice of the proper arm for injection in relation to the suspected lesion is important.

The chief cause of obstruction is neoplasm. Occasionally the obstructing tumor may be benign. Actual invasion into the lumen of the vein by the neoplasm may occasionally be demonstrated. Obstruction may also be caused by thrombosis and aneurysm. Slight degrees of block may be produced by non-neoplastic enlargement of the nodes.

Collateral circulation is well shown in complete block. Dilatation and displacement of the superior vena cava and innominate veins, with their causes, are considered.

Seventeen roentgenograms; 3 drawings; 2 tables.

LAWRENCE A. DAVIS, M.D.
University of Louisville

Superior Vena Caval Obstructive Syndrome. Report of Three Cases. William A. Lell. Ann. Otol., Rhin. & Laryng. **60:** 754–765, September 1951.

Three cases of superior vena caval obstruction due to an encroaching malignant tumor are reported. All showed the typical findings of gradually developing edema of the neck and face with subsequent extension to the arms and hands and engorgement of the veins of the chest. The rapidity with which these changes progress depends entirely upon the degree of obstruction of the superior vena cava and the location of the lesion in relation to the vena azygos. When both these vessels are involved, the edema occurs with lightning rapidity.

Although these cases presented the same typical objective changes, each offered a puzzling diagnostic problem as to the etiologic factor. Exploratory thoracotomy revealed the true cause. In one case the clinical course was quite deceptive and in the early stages simulated a possible antibiotic reaction or even Hodgkin's disease. The endoscopic examinations did not reveal encroachment on the trachea or right main bronchus in any instance. Cytologic examinations of secretions aspirated bronchoscopically were negative for tumor cells in two cases and suspicious in one. In all three instances the roentgen examination showed evidence of tumor.

Eight roentgenograms. STEPHEN N. TAGER, M.D.
Evansville, Ind.

Diagnosis and Treatment of Superior-Vena-Cava Obstruction. Karl P. Klassen, Neil C. Andrews, and George M. Curtis. Arch. Surg. **63:** 311–325, September 1951.

Gradual obstruction of the superior vena cava causes venous distention and edema of the head, neck, and upper extremities. The fully developed syndrome is readily recognized, but must be differentiated from cases in which there is retardation of right auricular filling, such as occurs in congestive heart failure and pericardial disease. Cardiac disease causes generalized venous hypertension, however, while superior vena cava obstruction limits the increased venous pressure to the upper portion of the body.

The surgical anatomy of the mediastinum with respect to the superior vena cava is reviewed, with a discussion on the collateral circulation. The cases of 12 patients having verified superior vena cava obstruction are described. Etiological factors included Hodgkin's disease, traumatic thrombosis, mediastinal teratoma, bronchogenic carcinoma, neuroblastoma, carcinoma of the thymus, mediastinitis, constriction by a pericardial band, and aneurysm of the innominate artery.

Diagnostic roentgenograms, including venograms and aortograms, are used to illustrate the discussion.

Ten roentgenograms; 1 photograph; 3 diagrams; 2 tables. FRANK T. MORAN, M.D.
Lancaster, Penna.

Saccular Aneurysms of the Internal Carotid Artery in the Cavernous Sinus Occurring Bilaterally. Valentine Logue. Brit. J. Surg. **39:** 181–182, September 1951.

A 68-year-old patient gave a history of a severe generalized headache developing nearly two years earlier, associated with vomiting. Two days later her left eyelid drooped and an intense burning pain affected the left side of her forehead and face. The eyeball was immobile and she saw double. The condition had persisted up to the time of hospital admission. Twenty years earlier she had experienced these identical symptoms on the right side.

Roentgen examination of the skull showed "sharpening" and elevation of the anterior clinoid processes, with destruction of the posterior processes. The floor of the sella turcica was irregularly deepened. In the parasellar region on the right side there was a ring of dense calcification. In the view taken of the orbits, both sphenoidal fissures were seen to be expanded and the inferior margin of the lesser sphenoid wing on the left was eroded, with a resultant thin lateral wall to the optic foramen.

An arteriogram (using Thorotrast) confirmed the opinion that the calcified ring formed the wall of a large saccular aneurysm of the internal carotid artery at the cavernous sinus. A further arteriogram on the left side revealed an aneurysm occupying the anterior part of the left cavernous sinus.

These aneurysms have little tendency to rupture into the subarachnoid space, owing to the support given to the stretched arterial wall by the tough dural lining of the cavernous sinus.

The case is interesting because a clue to the diagnosis, the calcified vessel shadow, can be seen on the routine postero-anterior film.

Five roentgenograms; 1 photograph.
MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

The Normally Situated Arch of the Azygos Vein: Its Roentgenologic Identification and Catheterization. Herbert M. Stauffer, John LaBree, and Forrest H. Adams. Am. J. Roentgenol. **66:** 353–360, September 1951.

The image of the arch of the azygos vein is visible in postero-anterior chest films projected on end in a considerable percentage of normal individuals. In the supine right anterior oblique and supine anteroposterior views it may also be demonstrated at the level of the bifurcation of the trachea. The authors have found it possible to catheterize the azygos vein. With the patient in the right anterior oblique position, visualization of the azygos arch as it crosses the right main bronchus is provided.

Normally in the horizontal position the Müller maneuver causes a marked increase in the intrathoracic pressure with a tendency to suck blood into the large thoracic veins; thus the azygos vein is more prominent. In the upright position, the vein tends to empty out and is even less prominent after the Valsalva maneuver. It is stated that many patients unintentionally perform the Valsalva maneuver when told to take a deep breath during routine chest examinations.

The importance of differentiation of the azygos vein arch from an enlarged node, as in Hodgkin's disease, is illustrated by a case history.

The largest azygos veins demonstrated by the authors were in two cases with occlusion of the inferior vena cava. In the first case the vein was two-thirds the size of the aortic arch, probably due to accommodation of the vein to increased blood flow. The authors cite instances of enlargement in right heart failure, but usually pulmonary congestion obscures detail.

It is concluded that the marked variation in caliber of the vein with changes of position and intrathoracic

pressure so overshadows its changes with venous stasis or increased pressure as to make such changes of little diagnostic value.

Twelve roentgenograms; 2 drawings.

THOMAS S. LONG, M.D.
University of Louisville

Serial Roentgen Vasography of Periarticular Vessel Systems in Polyarthritic Rheumatism. A. Leb. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 251–258, September 1951. (In German)

Contrast filling of the arteries of the hand and arm was carried out to determine circulatory changes about the rheumatic joints of the fingers. During the earlier stages there may be hyperemic changes due to inflammation of soft tissues about the joint with broadening of capillaries and stagnation of blood flow, resulting in the release of oxygen and relative elevation of the carbon dioxide; later an ischemic condition ensues. Along with the usual x-ray signs of arthritis there is often observed a fleck-like atrophy in the more acute cases, becoming diffuse in the chronic condition. Findings are present in a large proportion of the acute cases during the course of the infection, and in a few cases of primary chronic polyarthritis. The circulatory disturbances must be considered as an etiologic factor in chronic polyarthritis.

The circulatory changes lend themselves well to investigation by vasography. A small incision is made in the brachial artery at the elbow under local anesthesia. Six to 12 c.c. of contrast material is injected. At the Central Roentgen Institute in Graz, from which this report comes, Thorotrast has been used for seven and a half years with no bad results, but the author states that he will consider discontinuing it when he can find a satisfactory substitute. The injection is made in two to three seconds, and films are obtained during the next minute or two at five-second intervals. After the second minute, films are made at fifteen- to thirty-second intervals. It is possible to observe accurately both the arterial and venous phases. It has been shown that the finer arterial divisions to the fingers, particularly to the terminal phalanges, are not visualized, and the larger supplying arteries are narrowed.

In the author's opinion, the relative ischemia definitely contributes to the degenerative changes and the calcium deposits in the soft tissues. The circulatory disorders have been shown to precede the changes in the joints and soft tissues.

Fourteen roentgenograms.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

SCLERODERMA

The Visceral Lesions of Scleroderma. J. Morrison Hutcheson. Virginia M. Monthly **78:** 459–462, September 1951.

Scleroderma is a generalized disease of connective tissue involving many organs and systems other than the obvious skin changes. The gastro-intestinal tract, lungs, heart, and blood vessels anywhere in the body may be involved. The pathological picture is that of edematous swelling of the collagenous fibers followed by thickening and replacement with dense fibrous tissue. Small blood vessels often become completely obliterated. Raynaud's phenomenon may be associated.

Roentgenologically evidence of scleroderma may be found in the lungs and esophagus. The lungs may show a cystic sclerosis or a compact sclerosis with no actual dissolution of pulmonary tissue. Roentgenograms show a diffuse mottling over the lower lungs, thinning toward the apex. In the esophagus there is rigidity, lack of peristalsis, irregular dilatation and marked delay in passage of barium unless gravity aids in the upright position. In severe cases gravity seems to be the only way that food is propelled to the stomach.

When the heart is involved it shows a non-specific flabby enlargement with basal congestion.

Nearly all cases will have involvement of the heart or pulmonary or digestive system. Two cases are reported having all three visceral manifestations.

Three roentgenograms; 1 electrocardiogram.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

TECHNIC: CONTRAST MEDIA

Colour in Radiography. G. E. Donovan and Glyn Jones. Proc. Roy. Soc. Med. **44:** 816–818, September 1951.

The authors present a very interesting attempt at making roentgenograms which may be more easily interpreted. The basic method consists of making three consecutive roentgenograms of the same part at different kilovoltages to produce varying degrees of penetration. Following development of these they may be translated into color by one of the following processes:

1. *Optical Projection Method:* The three roentgenograms are projected simultaneously through different projectors, each equipped with a different color filter. The three images are superimposed on a screen with the combined colors.
2. *Chromoscopic Method:* A viewing box equipped with mirrors and filters provides each roentgenogram with a different color and superimposes the images.
3. *Trichrome Carbro Method:* This is a color separation process, in which a color transparency in one of the three primary colors is made from each roentgenogram. These are then superimposed to give composite color transparency.
4. *Color X-ray Transparencies:* By this method the three roentgenograms are photographed serially on the same frame of color film, each through a different color filter. This produces a composite color picture of 35 mm. or other size desired.

[By any of the above methods, it is possible to achieve some interesting results that may be helpful in diagnosis, but it is extremely doubtful that the meticulous work necessary for each final picture would ever permit its use in routine diagnostic roentgenology. It is, however, a step on a new path, and the authors should be commended for their attempts at pointing out new directions for exploration.]

EVERETT L. PIRKEY, M.D.
University of Louisville

"Kymo-kinokopie" According to Stumpf. H. H. Weber. Radiol. clin. **20:** 283–285, September 1951. (In German)

This is a report of a demonstration of kymo-kinokopie which, according to the reporter, has been developed by Stumpf and is used by him to show movements of the gastro-intestinal tract, particularly the

slow movements of the colon. A single kymogram of the organ under investigation is taken in the same manner in which the conventional kymogram of the heart is obtained. Instead of viewing the kymogram directly through a slotted moving grid, Stumpf took motion pictures of the finished kymogram through this grid, which Weber then projected.

The author claims that his method is without the following disadvantages of roentgen-kinematography: (1) high x-ray exposure of the patient (500 r for a kinematogram of the stomach versus 10 r for a gastric kymogram); (2) impossibility of recording slow movements because the radiation tolerance would then be exceeded. (3) inability to speed up artificially intestinal movements which are so slow as to escape visual detection otherwise.

[*Comment:* It is to be noted that Dr. Weber compares his procedure to roentgen cinematography obtained by photographing a fluoroscopic screen. In America a comparable study would be made with a rapid cassette changer, in which case the disadvantages claimed in (2) and (3) do not hold. With this latter technic the x-ray exposure is proportional to the number of frames taken. A study of a slow movement will consume more time, but the x-ray-free interval between the sequential pictures will likewise be greater if time condensation (*i.e.* artificial speed up) is undertaken. The total number of frames and the x-ray exposure will be the same.

The advantage of kymo-kinokopie over the direct viewing of a kymogram through a slotted grid is not discussed.—Ed.]

Two illustrations. GERHART S. SCHWARZ, M.D.
New York, N. Y.

Simple Method of Localizing Foreign Bodies in the Hand. David A. Willis. Am. J. Surg. **82**: 508–509, October 1951.

An apparatus for localizing radiopaque foreign bodies in the hand, which has proved extremely accurate, is described. It consists of a wire mesh screen about 2 inches square, with subdivisions about 1/4 inch square. One-fourth inch lead numerals are fixed in the squares along one edge of the screen, and letters of the same size in the squares on an adjacent end.

The hand is surgically prepared and fixed to an operating board in the desired position. The screen is then tied to the hand by means of tapes attached at the four corners, and a roentgenogram is taken, with a tube-film distance of at least 40 inches. During this procedure the fixing board should lie flat upon the cassette. The wet film will show the position of the foreign body on the screen, with the numerals and letters serving as guides.

One roentgenogram; 1 photograph.

Arteriography. A Useful Addition to the Technique. Charles G. Drake. J. Neurosurg. **8**: 545–546, September 1951.

The author describes the use of polyethylene tubing between the syringe and needle in carotid artery injection. The flexible polyethylene tubing allows the needle in the artery to remain stationary in spite of any movement of the syringe during the injection. The operator's hands are not in the zone of high radiation. With the syringe full of saline, the blood can be seen moving to and fro in the tubing, enabling the operator to be sure the needle is still in place between the injections of Diodrast. Sterilization is effected by soaking the adapters and tubing in 1:1,000 aqueous Zepharin for 24 hours. The necessary adapters are easily inserted after the tubing has been heated in boiling water. The inside diameter is enlarged by stretching with a mosquito forceps. The joint is made permanently secure by immediate immersion in cold water.

One photograph. HOWARD L. STEINBACH, M.D.
University of California

New Considerations of Failure of Elimination of Colloidal Thorium Dioxide Employed as a Contrast Medium in Radiology. M. E. Jörg and J. A. Aguirre. Radiología (Panamá) **1**: 79–87, March 1951. (In Spanish)

Since 1930 the authors have been concerned with the dangers attending the use of thorium dioxide in colloidal suspension as a contrast medium. In a study on its use in hepatosplenography which they presented in 1946 (Arch. Inst. cir. prov. Buenos Aires **1**: 302, 1946) they pointed out that it is not eliminated from the organism and continues to emit irradiation which intensifies progressively, producing local objective changes, such as granulomatous formations and parenchymal necrobiosis, and otherwise harmfully influencing the connective tissues and hemocytopoietic apparatus. Nor can it be defended as an indispensable element in roentgen diagnosis. Theoretical and practical substitutes have been found in the halogenated fatty acids which can be injected simultaneously for hepatosplenography and cholecystography.

The authors now express alarm that physicians still insist on using colloidal suspension of thorium dioxide as a contrast medium in pyelography and cerebral angiography, ignoring the fact that the injected element may produce localized granulomas and blocking of the reticuloendothelial system with consequences identical with those indicated as constituting dangers in hepatosplenography.

In view of the warm defense of hepatosplenography with thorium dioxide by Yater, based on his experiences in 300 cases, the authors report new observations regarding the persistence of colloidal thorium dioxide in the kidney following pyelography, and in the liver, spleen, and abdominal glands seventeen years after injection.

This is an excellent article, thought-provoking, and well worth reading.

Four roentgenograms. JAMES T. CASE, M.D.
Santa Barbara, Calif.

RADIOTHERAPY

Hürthle-Cell Cancer of the Thyroid. A Review of Forty Cases. Edgar L. Frazell and Benedict J. Duffy, Jr. Cancer **4**: 952–956, September 1951.

The term "Hürthle-cell cancer," as applied to a specific histologic variety of thyroid tumor, has been in fairly common use for several decades. Because of its relative rarity and because of the considerable dispute concerning the origin of the term "Hürthle-cell," little has appeared in the literature concerning the diagnosis, treatment and prognosis of this type of tumor.

The authors present a report based on the study of 40 patients with histologically confirmed Hürthle-cell cancers of the thyroid observed at the Memorial Hospital (New York) during the years 1930 to 1949 inclusive. This represents approximately 10 per cent of thyroid cancers seen at this institution. The median age of the patients on admission was fifty years, and 27 women and 13 men comprised the series.

In the untreated case of Hürthle-cell cancer of the thyroid the initial symptoms and physical findings appear to be essentially those associated with a benign adenoma. In several patients in the present series the swelling in the thyroid had been present over a period of years. The clinical course tends to be prolonged, the disease remaining localized in the neck for many years in some cases. Widespread local invasion of surrounding structures, such as the larynx, trachea or parotid sheath was encountered at surgery in 10 patients. Distant metastasis to the bones, lungs, and other viscera was also noted. Osseous lesions were present on admission in 7 of the series.

The authors believe that surgery offers these patients the best chance of long-term survival and possibly of cure. Postoperative irradiation has been discouraging in this form of cancer. In 7 of the patients with recurrent disease, postoperative irradiation had been given previously. External irradiation has given some palliation in the relief of pain from osseous metastasis, but the beneficial effects have been of a limited nature.

In the determination of prognosis the authors believe that the most important factor is the stage of disease on admission. Histologic evidence of vein invasion is a bad prognostic sign. Of the 40 patients studied, 18 were living without evidence of disease at the time of the report, although several of these had been followed for only a short time.

Four tables.

D. S. CHILDS, Jr., M.D.
Rochester, Minn.

Limited Surgery After Failure of Radiotherapy in the Treatment of Carcinoma of the Larynx. Max L. Som. Ann. Otol., Rhin. & Laryng. **60**: 695–703, September 1951.

The outstanding advantage of the Coutard method of protracted irradiation is the ability to deliver a cancericidal dose to the tumor with minimal damage to the laryngeal structures and the overlying skin in most cases. The author has had repeated occasion to perform total laryngectomy after a full course of radiotherapy had failed to cure the carcinoma. In every such instance where the tumor was found to be resectable, adequate healing and a permanent closure were obtained. In isolated cases, pedicle skin grafts had to be resorted to, but final healing was always accomplished.

The likelihood of effecting a cure and preserving the larynx in radiation therapy of carcinoma depends on the location of the tumor and the extent of its invasion. In the author's experience, the microscopic characteristics of laryngeal carcinoma have little or no bearing on the response of the tumor to radiotherapy. Cordal neoplasm and lesions of the ventricle and epiglottis ordinarily respond well to protracted radiation. Even after radiotherapy has failed to destroy the tumor, the probability of effecting a cure by cordectomy *via* laryngofissure or thyrotomy still remains. Such limited surgery was performed in 4 cases of carcinoma of the larynx not responsive to radiotherapy. Delayed but complete healing was obtained in every instance, with the preservation of an intact larynx.

These 4 cases are of interest since they dispel the current notion that limited surgery cannot be safely performed after a full course of protracted, carefully administered irradiation. In these instances, the postoperative course was uneventful, although healing was somewhat delayed. Of interest also is the effect of radiotherapy on the neoplasm, where cure was not attained. In 2 cases a carcinoma not initially suitable for laryngofissure was rendered amenable to such limited procedure. In 2 instances, although the entire lesion was not sterilized, the major portion was destroyed, leaving only a minute residue. The author believes it may well be that this represented the original parent cell, the daughter cells having been destroyed. "It would seem," he states, "that the idea that a neoplasm is either entirely radiosensitive or radioresistant is fallacious. Certainly, in these two cases, the residual carcinoma was barely detected by the pathologist, after biopsy had been done."

Occasionally cure of a primary carcinoma of the larynx is effected by thyrotomy or radiotherapy, only to be followed by the development of cervical metastases. Most probably such local lymph node invasion is the result of lymphatic emboli from the original tumor. It appears possible, in such instances, to perform a radical neck dissection for cervical metastases without disturbing the intact larynx. Two cases are reported demonstrating the feasibility of this procedure.

One photograph; 5 photomicrographs.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Pathology and Treatment of Adenocarcinoma of the Cervix. S. B. Gusberg and J. A. Corscaden. Cancer **4**: 1066–1072, September 1951.

The authors present a study of 58 cases of adenocarcinoma of the cervix with the object of defining the biologic characteristics of this tumor as an aid to the formulation of its treatment. Ten of the 58 cases were separated as probably representing carcinoma of the corpus that had extended into the cervix, leaving 48 cases that on histologic and clinical grounds were considered to be primary in the cervix. The average age of patients with adenocarcinoma of the cervix was 51.9 years, which is somewhat higher than the average for squamous carcinoma of the cervix. It is interesting to note that the majority of cervical carcinomas occurring in Jewish women were adenocarcinoma. There

was no significant difference in the clinical extent of adenocarcinoma as compared to squamous-cell carcinoma of the cervix. Nineteen of the patients were in Stage 1, 15 were in Stage 2, 11 in Stage 3, and 3 in Stage 4.

In general, the follow-up of many of these cases was not long enough to permit a significant five-year analysis of results. Twelve of the 48 patients, however, were living at the end of five years, making an absolute five-year survival of 25 per cent. Thirty-eight of the patients were analyzed as to radiosensitivity of the tumor. For the study of this factor, the authors used the disappearance of the primary lesion in the early post-treatment period. Of the 38 patients, 22 proved radiosensitive, in that the lesion disappeared. There were 16 patients whose tumors appeared insensitive, but of this group 9 cannot be judged precisely since they appeared for treatment with advanced inoperable tumors in Stages 3 and 4, and palliative therapy only was administered. The remaining 7, or 18.4 per cent, were considered radioresistant in that there was steady progression of the disease which was unchecked by treatment.

The authors conclude that in general the radiosensitivity of these adenocarcinomas does not appear strikingly different from that of the usual group of squamous-cell cancer of the cervix. The decision as to irradiation or surgical treatment of a cervical adenocarcinoma cannot be based on any biological difference between adenocarcinoma and squamous-cell carcinoma that could be discerned.

Seven photomicrographs; 3 tables.

D. S. CHILDS, JR., M.D.
Rochester, Minn.

Effect of Radiation on Metastatic Pelvic Lymph Node Involvement in Carcinoma of the Cervix. Willis E. Brown, I. Meschan, Ernest Kerekes, and J. M. Sadler. Am. J. Obst. & Gynec. **62:** 871–887, October 1951.

A series of cases of squamous-cell carcinoma of the cervix is presented in which treatment was based on standardization of quantity of radiant energy delivered to the local lesion and lateral pelvic lymph nodes. With this technic the desired dosage is achieved with x-rays, radium, and cobalt^{60}. The x-rays are delivered from 220-kv. machines at 15 ma., a target-skin distance of 50 cm., and h.v.l. equal to approximately 1.5 mm. of copper. Six to 8 portals are used according to the patient's measurements. The gamma radiation is from radium or cobalt^{60} shielded by 1.0 mm. platinum or its equivalent. An Ernst applicator or multiple needles are used as indicated. The gamma and x-ray roentgens are summated directly, 5,000 to 6,000 r being delivered to the lateral pelvic wall, 10,000 or more to the cervix, and less than 4,000 to the rectum and bladder. The radium effect is mainly on the cervix, while the x-rays primarily affect the lateral pelvic nodes. Fairly satisfactory distribution throughout the pelvis is obtained by integrating the isodose curves of x-ray and radium. Distances from skin and cervix to various pelvic points are measured by external calipers and by anteroposterior and lateral radiographs with a skin clip on the cervix. The bladder and rectum are identified by contrast media. Roentgens delivered to pelvic points are calculated by use of converted Quimby tables.

In the series reported, surgery was done two to twelve months after irradiation, and the radiation effect on the tissues was studied. A Wertheim hysterectomy with extensive node dissection is done where possible.

Three out of 24 patients had residual carcinoma in the cervix and extensive carcinoma throughout the pelvis at the time of surgery. All had received more than 10,000 r to the cervix. These tumors were apparently radioresistant. In 3 patients the cervix was negative at surgery but carcinoma was found in the upper pelvis, probably because of inadequate combined radiation dosage at the upper edges of the skin portals. In the other 18 cases the cervix was negative and no viable carcinoma was found at operation.

On the basis of these observations, it is concluded that 5,000 to 6,000 "tissue roentgens" seems to be the minimal concentration of radiation that will eradicate carcinoma in the pelvic lymph nodes in radiosensitive tumors, when delivered in five to six weeks. Certain tumors have proved to be radioresistant to two or three times the usual cancericidal dose.

All pelvic nodes showed extensive evidence of irradiation effect, with areas of hyalinization and focal necrosis. Irradiation endarteritis and fibrosis extending over six to nine months increase the difficulty of surgical dissection and reduce the blood supply, compromising postoperative healing. Since the fibrosis does not become significant until three months after irradiation, surgery should be done relatively early if it is to be employed.

Eight figures, including 4 roentgenograms; 6 tables.

MASON WHITMORE, M.D.
Jefferson Medical College

Carcinoma of the Ovary: Clinical and Pathological Evaluation. Frank C. Wheelock, Robert H. Fennell, Jr., and Joe V. Meigs. New England J. Med. **245:** 447–449, Sept. 20, 1951.

Sixty-seven cases of malignant ovarian tumor were seen at the Massachusetts General Hospital between 1935 and 1943, with a five-year survival rate of 28.4 per cent. A previous series, 1901–34, had shown a five-year survival of only 15.5 per cent (Meigs: Surg., Gynec. & Obst. **71:** 44, 1940). Seventy-nine per cent of the patients in the more recent series were between the ages of forty and seventy, the peak incidence being in the sixth decade, and the range from twenty-two to seventy-six years. The patients did not differ significantly from the general population with respect to marriage or pregnancy. Symptoms such as pain, an abdominal mass, and swelling were due to the presence of the tumor or to its pressure on adjacent structures. Sixteen patients experienced abnormal vaginal bleeding.

The tumors were graded on the basis of frequency of mitosis, degree of invasiveness, pleomorphism of cells, amount of secretion in the cells, and the degree of piling up of the epithelium in cysts. Using these criteria, the prognosis of good, fair, or poor was made, and those tumors which appeared to be slow-growing and well differentiated were found generally to be less lethal than the others. Patients with cystic tumors had a more favorable prognosis than those with the cystic-solid or solid types.

Forty-eight of the 67 patients received one or more courses of x-ray therapy, the amount per course, measured as skin dose, ranging from 2,000 to 7,500 r. The results of treatment were as follows:

Type of operation	Total Group No. of Cases	5-Year Survivals X-ray Treatment No. of Cases	X-ray Treatment
Complete removal ..	27	19	15	10
Partial removal	24	18	3	2
Biopsy only	10	6	1	1
No operation	6	5		

The authors attribute the improvement of 11 per cent in their longevity statistics to the more aggressive surgical treatment and the use of x-ray therapy. The proper therapy for ovarian cancer is surgical removal of the tumor, the other ovary, both tubes and uterus, including the cervix. X-ray therapy is certainly indicated if the tumor has been incompletely removed. If the cancer is thought to have been completely removed, the decision concerning radiation must be made on the basis of the individual case.

Four tables. MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Primary Carcinoma of the Vagina. Bawa P. Singh. Cancer **4**: 1073–1082, September 1951.

Of 2,059 patients with genital cancer treated at the Sloane Hospital for Women (New York) between the years 1925 and 1949, 21 or 1.52 per cent were found to have primary carcinoma of the vagina. Eight of the 21 were treated with radium, 7 with radium and deep roentgen radiation, 2 with surgery and 1 with surgery and deep roentgen radiation. Two with advanced disease were given no specific treatment One patient was treated with deep roentgen radiation alone. There were no five-year survivals in the series. Only 2 patients remained alive at the time of the report, apparently well at twenty-eight and eleven months after radium therapy and surgery, respectively.

The experience of this hospital indicates the need for a more systematically applied technic of radiation therapy and in selected cases for more radical surgery. The author presents a technic employing a tandem placed in the central axis of the vagina which will allow a tumor dose of at least 7,000 gamma roentgens at 1 cm. beneath the surface of the vaginal mucosa. Dosage measurements for variously situated lesions are presented.

Three photomicrographs; 5 tables.
D. S. CHILDS, JR., M.D.
Rochester, Minn.

Malignant Testicular Tumors: Clinical and Therapeutic Evaluation of 158 Cases. Gustave Kaplan, Benjamin B. Cohen, and Bernard Roswit. Am. J. Roentgenol. **66**: 405–419, September 1951.

This paper is a record of the experiences gained in the management of malignant tumors of the testicle at the U. S. Veterans' Hospital, Bronx, New York. The classification, incidence and average age of occurrence were as follows:

Seminoma	36.4%	35 years
Embryonal carcinoma	36.4%	33 years
Teratocarcinoma	15.2%	31.3 years
Choriocarcinoma	6.0%	26.3 years
Miscellaneous	3.0%	

1 lymphosarcoma
2 reticulum-cell sarcoma
1 rhabdomyosarcoma

The incidence in Negroes has previously been reported as low, and there were none in this series.

The most common presenting symptom was testicular swelling, followed in order by testicular pain, back pain, and abdominal pain. History revealed trauma in 16 per cent of the series, hydrocele in 5 per cent, nondescent of the testicle in 4 per cent, and orchitis in 2 per cent.

Metastasis was almost entirely by way of the lymphatics. On admission or during the course of the disease, metastases were demonstrated in 60 per cent of the cases. The incidence was highest in choriocarcinoma (80 per cent) and embryonal carcinomas (79.3 per cent) and lowest in seminoma (43.1 per cent). Abdominal nodes, peripheral nodes, and the chest were the most frequent sites. Bone metastases were infrequent, being seen in only 3 cases, all seminomas.

The plan of treatment was surgical removal of the involved testicle followed immediately by deep x-ray therapy to the abdominal lymph-node bearing area in all patients. Resection of the nodes is not practical because total removal is considered impossible.

Irradiation was given for the most part at 400 kv., h.v.l. 4.3 mm. Cu, 5 ma., and 70 cm. distance. A daily depth dose of 150 r was given to the upper and lower abdominal zones alternately, and 100 r daily to the inguinal region. If no metastatic nodes were clinically demonstrable, three anterior portals were used—(1) epigastric, (2) lower abdominal, and (3) inguinal—and two fields were used posteriorly—(1) combined upper lumbar and lower dorsal, and (2) lower lumbar. Thus, cross-fire radiation was delivered to the upper and lower retroperitoneal zones and to the inguinal area for a depth dose of 2,000 r for seminoma, and 3,000 r for the other histopathological groups. In resistant cases higher doses were not helpful.

The authors believe that all patients should probably be treated as though microscopic metastases were present. However, the presence or absence of clinically demonstrable metastases seems to have a significant bearing on prognosis. Only seminomas are classed as radiosensitive, but all types should receive irradiation, not only for its palliative benefit but, in some instances, with the object of cure.

Of the 54 patients with seminoma in this series, 18 died in less than three years, 9 were alive after five years or more, 6 after three to five years, and 21 for lesser periods. The three-year survival rate is given as 45.5 per cent. For the other tumor types the following three-year survival rates were obtained: embryonal carcinoma (55 cases followed), 32.6 per cent; teratocarcinomas (24 cases), 26.6 per cent; choriocarcinomas (10 cases), 11.1 per cent.

All deaths occurred within the first three years following treatment.

The paper is well supplemented by 5 tables, 5 case reports with numerous reproductions of films and histological sections, and a diagram illustrating lymphatic drainage and arrangement of treatment portals.

Sixteen roentgenograms; 7 photomicrographs.
I. EARL HOLMES, M.D.
University of Louisville

Hodgkin's Disease, Lymphosarcoma, Reticulum-Cell Sarcoma: Radiotherapy. René-J. Gilbert. Radiol. clin. **20**: 313–336, September 1951. (In French)

In general, radiotherapy remains the treatment of

choice in lymph node tumors. An attitude of hopelessness in these cases is not to be condoned. Peters (Am. J. Roentgenol. **63:** 299, 1950. Abst. in Radiology **56:** 313, 1951), staging cases of Hodgkin's disease clinically, according to the extent of involvement, reported an 88 per cent five-year survival in Stage I (disease localized to one lymph node area), 72 per cent in Stage II (involvement of two adjacent lymph node areas), and 9 per cent in Stage III (disseminated disease). The author has a much smaller group in Stage I, but notes the same general trend. He quotes a 67 per cent five-year survival in 6 Stage I cases; 2 patients not receiving treatment died. Of 41 patients with Stage II disease, 20, or 49 per cent, survived five years, while only 17 per cent of 47 patients with Stage III involvement survived five years.

In general, intensive radiotherapy is indicated in all localized forms of lymphoid tumors, while palliative treatment is indicated in the disseminated forms. Radioactive phosphorus is useful in chronic lymphatic leukemia, alone or as an adjuvant to roentgen therapy. Nitrogen mustards may act as a useful adjuvant in Hodgkin's disease.

Twelve roentgenograms; 7 tables.

CHARLES M. NICE, M.D.
University of Minnesota

Treatment of Angiomas in the Radiotherapeutic Clinic of the University Hospital of Leyden from January 1946 to May 1949 (308 Cases). P. J. L. Scholte. Acta radiol. **36:** 241–252, September 1951. (In French)

Contrary to some reports, a large percentage of hemangiomas not only fail to disappear or cease growing but, in fact, continue to grow. Since, therefore, hemangiomas respond to radiotherapy best in infancy, since the treatment of smaller tumors results in smaller scars, and since one cannot foresee which lesions will regress spontaneously, it is recommended that therapy be given in the early months of life.

Spider nevi are relatively insensitive to irradiation. Lymphangiomas and mixed hemango-lymphangiomas require high doses. The elevated strawberry type and the cavernous type, which may extend under the skin, are relatively radiosensitive.

Treatment should be individualized according to area and depth, with the form of roentgen or gamma radiation which best suits the particular case. Use of radium results, as a rule, in a better esthetic effect. Recently felt moulages have been used in place of wax moulages. Radium needles or radon seeds have been employed for subcutaneous growths. Relatively soft irradiation is used about the eyes, palms, plantar surfaces, and scrotum.

For superficial angiomas, contact roentgen irradiation, 620 to 765 r, is given from one to three times, with intervals of one and a half to three months. The smaller dose is used in facial lesions, while the larger doses are required on the relatively less sensitive lesions of the buccal mucosa.

For cavernous hemangiomas, a dosage of 3,000 gamma r to the surface, in twenty-four hours, at a distance of 1 cm., is given. Fractionated radium therapy, consisting of 1,000 gamma r in two treatments six weeks apart, may be used. If the lesion does not extend below the surface, roentgen rays may be employed. Local compression of the angioma during treatment may be of advantage.

In patients with extensive lesions roentgen therapy at 100 to 140 kv., with 3 mm. Al filter, is indicated. The dosage is 400 r given in one to three treatments, spaced one to three months apart. Unfortunately, many of these relatively extensive lesions are in older children or adults, and some have necessitated total dosage as high as 5,000 to 6,000 r for eradication. For very thick lesions, 180 kv., with 0.5 mm. Cu filter, has been used.

It is quite evident that the treatment of each patient must be individualized according to need.

Four illustrations.

CHARLES M. NICE, M.D.
University of Minnesota

New Studies Experimental and Clinical on Pemphigus. David I. Macht. Urol. & Cutan. Rev. **55:** 550–559, September 1951.

The author has carried out phytopharmacological studies of blood sera in a wide variety of skin diseases. Using the *Lupinus albus* seedling it was determined that pemphigus sera produced a characteristic toxic effect inhibiting the root growth. This was the origin of the so-called Macht-Pels test, which proved to be 90 per cent reliable. It was found further that, if the serum was given a brief exposure to filtered x-rays, there was a marked loss of toxicity not observed in sera from other dermatoses. This is the origin of the Macht-Ostro test which, when taken together with the Macht-Pels test, renders the diagnosis of pemphigus in doubtful cases about 95 per cent accurate.

The detoxification of pemphigus serum *in vitro* by irradiation suggested a trial of radiotherapy in patients suffering from the disease, and the writer states that he has followed at least 12 cases which were "benefited more or less" by roentgen therapy over the liver and spleen, while a number of cases which have been successfully treated by this means have been reported to him by others. Some physicians, on the other hand, have obtained no response to irradiation. This is believed to be due to the wave length used. It has been shown by the use of special filters that the most effective rays for detoxifying pemphigus toxin are those obtained with a filtration of 2.0 mm. copper and 1.0 mm. aluminum (Macht and Ostro: Am. J. Roentgenol. **61:** 534, 1949).

The above observations and positive phytopharmacologic tests of the spinal fluid of pemphigus patients indicate that the disease is not to be considered solely a skin condition but that it is a systemic disease with cutaneous manifestations.

The remainder of the paper includes a discussion of the nature of the pemphigus toxin, the relation of the disease to the suprarenal cortex, and the detoxifying effects of ACTH and Cortisone.

It is of interest that the serum of a newborn infant whose mother died of pemphigus following delivery was positive for twenty-eight days.

Ten tables.

THOMAS S. LONG, M.D.
University of Louisville

Lymphoepithelioma of the Nasopharynx. Errol A. Thompson. Arch. Otolaryng. **54:** 390–408, October 1951.

Lymphoepithelioma is an uncommon primary malignant neoplasm, usually occurring in the pharyngeal region associated with Waldeyer's ring of lymphoid tissue. It is composed of large immature anaplastic

epithelial cells which are intimately associated with lymphoid cells; it tends to metastasize early and rapidly, is highly malignant, and extremely radiosensitive. Four cases are reported.

The first, and principal, case illustrates the usual course of events in lymphoepithelioma of the nasopharynx. There was a minimum of three months before the patient sought treatment for a "stuffy nose," epistaxis, and weight loss. Four more months passed before a diagnosis of malignant tumor was made. Ten months from the beginning of symptoms and seven months after medical attention was sought, a specific diagnosis of lymphoepithelioma was made. Two months later, or a year from the start of symptoms, the primary tumor was positively proved to be in the nasopharynx.

Treatment of lymphoepithelioma is almost exclusively by roentgen irradiation. Intensive fractional roentgen therapy to the site of the primary tumor and to the usual bilateral routes of extension is the procedure of choice. The dose is regulated by the extent of the disease, the patient's general condition, and the reaction to treatment. All of the author's patients were treated by roentgen therapy. The first patient had had two and one-half years of freedom from recurrence after treatment was instituted. For the other 3 patients late results were unavailable.

Six photomicrographs; 1 chart.

Osteitis Pubis and Its Treatment by Roentgen Irradiation. T. Leucutia. Am. J. Roentgenol. **66:** 385–404, September 1951.

A comprehensive review of the literature showed that 116 cases of osteitis pubis have been reported. To these the author adds 4 cases of his own.

Osteitis pubis is a distinct clinical entity characterized by a self-limited non-suppurative osteonecrosis which usually begins at the symphysis and extends to the pubic bones. The lesion usually follows urologic surgery as a troublesome postoperative complication, the main symptom being excruciating pain that occurs six to eight weeks after surgery. This is followed by progressing disability and increased pain as the process extends to involve more bone and more muscular or tendinous attachments. Early physical signs are few—slight to moderate swelling and tenderness to palpation over the symphysis. There are no signs of local inflammation and there is no evidence of accumulation of pus.

The author divides the roentgenographic findings into three stages. In the prodromal stage (one to seven weeks), the roentgenograms are negative or show only a slight fraying of the corners of the symphysis or joint fuzziness of the rami of the pubic bones. The involved bones then go through a destructive stage and finally a stage of regeneration or repair. The conditions to be considered in differential diagnosis are osteomyelitis (fever, toxemia, sequestration), metastatic cancer, and, more rarely, tuberculosis and syphilis of the pubic bones.

The various theories concerning the etiology of the disease are discussed.

In previous cases treated by roentgen therapy and in the 4 cases reported by the author, irradiation was of great value in controlling and alleviating pain and decreasing disability. A dose of 75 to 100 r in air (200 kv., 1 mm. Cu) triweekly until acute symptoms have subsided is recommended. Treatment should be discontinued as soon as satisfactory alleviation of symptoms has occurred, with no effort to treat until normal bony architecture has been restored. With roentgen therapy the pain is relieved in a few weeks or months and the period of disability is reduced from an average of ten months to an average of six months.

Sixteen roentgenograms; 3 tables, including a compilation of the reported cases.

WILLIAM H. SMITH, M.D.
University of Louisville

Considerations on the Roentgen Therapy of 207 Cases of Arthropathy. Sordello Attili. J. belge radiol. **34:** 367–373, 1951. (In French)

A total of 207 patients with non-tuberculous arthropathies, including a wide variety of types—infectious, chronic inflammatory, ankylosing spondylitic, degenerative, gouty, tabetic, hemophilic, post-osteochondritic, sclerodermic, bursitic and peri-articular (Pellegrini-Stieda, etc.)—were treated by roentgen irradiation, with favorable results in 82 per cent. Although the number of cases in each group is listed the percentage of good results in each is not given. A total of 1,500 to 1,600 r was given to each field in eight to ten daily (or every other day) treatments (160–180 kv., 0.5 mm. Cu plus 3.0 mm. Al filter). Roentgen therapy complements, rather than precludes, other forms of therapy, both physical and medicinal.

Two roentgenograms.

CHARLES M. NICE, M.D.
University of Minnesota

Radiotherapy of the Arthroses. Giovanni F. Gardini and Carlo Pais. J. belge radiol. **34:** 374–376, 1951. (In French)

One hundred patients with dysplasic, degenerative, and metabolic types of arthroses were treated by roentgen irradiation. Post-traumatic, neuropathic, and chronic primary and second polyarthritic cases are excluded. Of the total, 80 per cent showed a favorable immediate response, but long-term observation decreased the good results to 50 per cent. The small articulations and those of the upper extremity respond well. In patients with congenital dysplasia, as in the hip, the response is poor as a rule.

CHARLES M. NICE, M.D.
University of Minnesota

Considerations on Roentgen Therapy of Vertebral Arthoses. Henri Ramioul. J. belge radiol. **34:** 420–425, 1951. (In French)

In 115 patients with arthroses of the spine, excluding infectious and traumatic types, relief of pain was achieved by roentgen irradiation in over 60 per cent. In general, lesions of the thoracic spine were most responsive.

Treatment was given at 200 kv., with 0.5 mm. copper filtration, to one or two ports, for a total dose of 1,200 to 2,500 r over a period of two or three weeks.

Four tables.

CHARLES M. NICE, M.D.
University of Minnesota

Radiotherapy of Bursitis and Scapulo-Humeral Periarthritis. Francisco Arce Alonso. J. belge radiol. **34:** 389–400, 1951. (In French)

Of 98 patients with bursitis or scapulo-humeral periarthritis, 86.2 per cent obtained favorable results with radiotherapy. In acute cases, 100 per cent re-

ceived relief and in the subacute and chronic phases, roughly two-thirds of the patients were improved.

Nine roentgenograms; 1 table.

CHARLES M. NICE, M.D.
University of Minnesota

Roentgen Therapy of Scapulo-Humeral Periarthritis, Called "Rheumatismal." R. J. Weissenbach and Pierre Pizon. J. belge radiol. **34**: 377–388, 1951. (In French)

Various theories of the pathogenesis of scapulohumeral periarthritis are discussed. Especial consideration is given to neuro-vegetative irritation with sympathetic excitation. Radiotherapy is said to suppress this excitation, with amelioration of the condition. Partial remission and total relief occurred in 85 and 51.25 per cent, respectively, of 80 patients treated.

CHARLES M. NICE, M.D.
University of Minnesota

Concerning Radiotherapy of Deforming Arthrosis of the Knee. Corte Real. J. belge radiol. **34**: 401–405, 1951. (In French)

Ninety patients with deforming arthrosis of the knee, known also as osteoarthritis, hypertrophic arthritis, and degenerative arthritis, were treated by irradiation (150 kv., 0.5 mm. Cu + 1.0 mm. Al filtration). Amelioration to complete relief of symptoms occurred in 84.3 per cent.

CHARLES M. NICE, M.D.
University of Minnesota

Roentgen Therapy of Internal Distortions of the Knee. Prophylaxis of Pellegrini-Stieda Disease. Germano Buzzi. J. belge radiol. **34**: 426–437, 1951. (In French)

After trauma involving the internal collateral ligament of the knee, early roentgen therapy relieves pain and prevents the calcification characteristic of Pellegrini-Stieda disease.

CHARLES M. NICE, M.D.
University of Minnesota

Roentgen Therapy in Still's Disease. Alfredo De Maestri. J. belge radiol. **34**: 406–415, 1951. (In French)

Definite amelioration of joint pain was observed after roentgen therapy in two children with Still's disease. The roentgen picture of the joints was not altered, but it is believed that the pathologic process is retarded by the therapy.

Six roentgenograms.

CHARLES M. NICE, M.D.
University of Minnesota

Chemical Dosimetry. W. Minder. Radiol. clin. **20**: 286–295, September 1951. (In German)

A chemical method is described which permits dosimetry of x-rays as well as the determination of the total dose delivered by radioisotopes. The author uses the oxidation of ferrous sulfate (n/200 $FeSO_4$ in 0.8 n H_2SO_4) as an indicator, the remaining non-oxidized material being measured by titration with potassium permanganate. Ionization measurements and titration values were compared after exposures to 250, 50, and 31.5-kv. roentgen radiation and fair agreement was found in all tests except at 250 kv.

To test the accuracy of the method when applied to radioisotopes, 103.53 millicuries of Rb^{86}, with a half-life of 19.5 days, was placed in a flask (9.55 gm. RbCl diluted in 700 c.c. n/500 $FeSO_4$ + 0.8 n H_2SO_4 solution) and left to decay. The total dose determined by titration after complete decay was only 4.8 per cent higher than the calculated one (175,000 r *vs.* 167,000 r).

Calculation of the dose delivered by radioisotopes is very difficult and in some instances impossible. The advantage of an experimental method which permits the actual measuring of this dose is obvious. The author believes that ferrous sulfate is not the ideal substance for this purpose and hopes that a better one will become available.

Five graphs.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

RADIOISOTOPES

Evaluation of the Radioactive Mapping Technic in the Surgery of Brain Tumors. Bertram Selverstone and James C. White. Ann. Surg. **134**: 387–395, September 1951.

The authors describe their experience with 150 cases in which the probing Geiger-Müller counter was used in conjunction with radioactive phosphorus or radioactive potassium, indicating that this technic may be relied upon to locate and demarcate cerebral tumors at operation.

An intravenous injection of 0.5 to 2 millicuries of radioactive phosphate ion is given on the day preceding operation or, alternatively, half of this amount of radioactive potassium ion may be similarly given during the course of the operation. Only the simplest equipment is needed in the operating room—a probing Geiger-Müller counter together with a pre-amplifier and standard scaler or, even more simply, a battery-operated portable counting rate meter. Each reading can be obtained within twelve to twenty-four seconds with the scaler or within approximately five to ten seconds with the counting rate meter. Normal control readings are first obtained through a presumably innocent region of the exposed cortex, following which the tumor is located or charted.

This method enables the surgeon to obtain a valid biopsy from active tumor tissue. It also permits him to decide in advance whether the extent of a neoplasm makes it inoperable; preliminary knowledge of its full extent permits him to judge whether total resection is possible by means of a radical lobectomy. Finally, when a patient presents a brief progressive history, with profound hemiparesis and aphasia, a simple trephination may be undertaken on neurologic grounds alone, a malignant glioma may be located with the counter, and a biopsy taken from a region of high radioactivity. In this way one may be assured of an adequate biopsy, a useless major craniotomy may be avoided, and the patient may be returned to his family within a few days of admission to the hospital.

Twenty-two illustrations.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Analysis of Techniques for the Determination of Thyroid Function with Radioiodine. Gordon L. Brownell. J. Clin. Endocrinol. **11**: 1095–1105, October 1951.

The advent of radioiodine has increased greatly the quantitative information which may be obtained concerning the physiology of the thyroid gland. In

addition to supplanting the technics for measuring the equilibrium constants of the gland, such as the percentage utilization of the daily intake of iodide, radioiodine allows the dynamic measurement of characteristics such as the rate of accumulation of iodide by the gland and the rate of release of hormone.

In general, a radioiodine test includes the administration of radioiodine (usually in the form of iodide), measurement of radioiodine content of the thyroid by means of external detection, measurement of radioiodine content of serum and urine, and mathematical analysis of the data. Two criteria are postulated as essential for a radioiodine diagnostic test: The test should be indicative of thyroid status and should measure a fundamental parameter of the thyroid. In support of the second criterion, the metabolism of labeled iodide and the release of labeled hormone by the gland are analyzed on the basis of simple models, and technics are discussed for the determination of fundamental constants for the experimental data. The metabolism of iodide by a myxedematous subject is presented as an example.

Six illustrations; 2 tables.

The Tracer Dose of Radioactive Iodine in the Diagnosis of Thyroid Disease. Lindon Seed, Bertha Jaffé, and Carl Baumeister. J. Clin. Endocrinol. **11**: 1143–1156, October 1951.

This effort to evaluate the clinical importance of the tracer dose of radioactive iodine in the diagnosis of diseases of the thyroid is based upon an analysis of the findings obtained in a clinical laboratory in an ordinary general hospital.

The 24-hour pickup of I^{131} by the thyroid gland and the 24-hour urinary excretion were determined on all patients. In about half the patients, blood was drawn at the end of twenty-four hours to determine the total plasma I^{131} and the protein-bound fraction (PBI^{131}). The ratio between these two was also calculated. The investigation was limited strictly to the following five factors: (1) the 24-hour thyroid pickup of I^{131}; (2) the 24-hour urinary output; (3) the plasma I^{131}; (4) the protein-bound fraction of I^{131}; (5) the ratio of protein-bound I^{131} to I^{131} in plasma.

The thyroid pickup and/or the urinary output of I^{131} were excellent diagnostic criteria in toxic diffuse goiter, less so in recurrent exophthalmic goiter, and of little value in pure toxic nodular goiter.

The total plasma I^{131} in itself was found of no value in diagnosis.

The PBI^{131} may be used as a single diagnostic test with reasonable accuracy, but the authors found it to be more erratic than the conversion ratio. In their experience the conversion ratio was the most accurate single determination, but it is not sufficiently superior to warrant the extra effort in carrying out the procedures and it is reserved for borderline cases.

Three graphs; 8 tables.

Radioiodine Studies in Thyroiditis. William M. McConahey and F. Raymond Keating, Jr. J. Clin. Endocrinol. **11**: 1116–1122, October 1951.

Much has been written on the pathology of acute and chronic thyroiditis, but comparatively little is known about the functional status of the thyroid in these conditions. Recently, however, the radioiodine tracer technic has provided a means of observing some aspects of thyroid function in thyroiditis. The authors present the results with tracer studies on 40 patients, 21 with acute diffuse thyroiditis, 13 with struma lymphomatosa, and 6 with struma fibrosa.

The uptake of I^{131} for the majority of the patients with acute diffuse thyroiditis was significantly less than that of normal persons, although the patients were euthyroid or hyperthyroid. In the 19 patients with chronic thyroiditis, accumulation of I^{131} in the thyroid was usually normal although 5 of the patients with struma lymphomatosa had myxedema. The collection of I^{131} by the thyroid in these conditions is not a measure of the secretion of thyroid hormone.

Three tables.

Pathological Effects and Radioautographic Localization of I^{131} in Humans: Postmortem Study in Nine Patients. John T. Godwin, B. J. Duffy, Jr., Patrick J. Fitzgerald, J. B. Trunnell, and Rulon W. Rawson. Cancer **4**: 936–951, September 1951.

The increasing administration of I^{131} in human thyroid diseases makes the localization and effect of this substance of paramount importance. The authors report extensive clinical and postmortem studies in 9 patients to whom carrier-free I^{131} was given in anticipation of postmortem studies. The dose of radioiodine varied from 1.91 to 250 mc. with the interval between administration and death varying from eight hours to thirty-five days. At autopsy three individual sets of tissues were taken if the organ was sufficiently large. One set was used for direct measurement by Geiger-Müller counter, one for routine paraffin section, and the third for radioautographic studies. Seven of the patients had carcinoma of the thyroid, 1 an intrathoracic goiter, and 1 a renal carcinoma with generalized metastasis.

Detailed case reports and tabulations of the radioautographic findings in each of the nine cases are presented. The distribution of I^{131} in both primary and metastatic lesions in these cases is similar to that previously reported for comparable histologic types. Histologic changes attributable to I^{131} were seen in the primary thyroid tumors and in some metastatic lesions. No other organs revealed changes suggestive of radiation effect, except for the bone marrow in one case.

Ten photomicrographs; 6 radioautographs; 10 tables.

D. S. CHILDS, JR., M.D.
Rochester, Minn.

Limitations and Indications in the Treatment of Cancer of the Thyroid with Radioactive Iodine. Rulon W. Rawson, J. E. Rall and Wendell Peacock. J. Clin. Endocrinol. **11**: 1128–1142, October 1951.

During the past five years several cooperating investigators at the Memorial Hospital (New York) and the Sloan-Kettering Institute have been engaged in physiologic studies of cancer of the thyroid and in evaluating the possible use of radioactive iodine in the treatment of such tumors. Twenty of the 146 patients with thyroid cancer studied received therapeutic amounts of radioactive iodine. Objective improvement as evidenced histologically and roentgenologically has been observed in 10. The present paper is devoted to a discussion of the indications and limitations of this type of treatment as the authors see them.

The *limitations* to the treatment of cancer of the thyroid with radioactive iodine are defined as follows:

1. The relative to absolute lack of natural avidity

for I^{131} of practically all cancers of the thyroid and the natural variability in function of those tumors which do concentrate radioiodine.

2. The physician-induced impairment to natural or induced avidity for radioiodine of certain tumors, *i.e.*, by the administration of iodine or iodine-containing drugs or by the administration of non-cancericidal amounts of radiation, isotopic or x-ray.

3. The damaging effects of the radiation from radioiodine on normal or vital tissues, *i.e.*, the blood and blood-forming organs.

The *indications* for the treatment of cancer of the thyroid with radioiodine are defined as follows:

1. That the tumor be not removable by a competent surgeon. Treatment with radioactive iodine for cancer of the thyroid which is localized to the thyroid and adjacent lymph nodes and can be removed by competent surgeons is indefensible.

2. That the tumor be capable of concentrating enough radioactive iodine to exert a cancericidal effect. Methods of inducing this function are discussed.

3. That the calculated total blood irradiation delivered by the proposed therapeutic dose of I^{131} be within the range of safety, *i.e.*, less that 500 rep.

Ten figures, including 4 roentgenograms; 1 table.

Uptake of Radioiodine in Frozen Thyroid Carcinoma Tissues. William N. Harsha and Barbara R. Harsha. Am. J. Clin. Path. **21**: 842–845, September 1951.

A technic of quick-freezing of thyroid carcinoma tissues, with subsequent tissue incubation studies on these tumors, is presented. The ability of quick-frozen thyroid tissues to metabolize radioiodine appears to be identical to that ability in the same tissue immediately incubated upon excision from the body.

It is felt that with this technic adequate studies may be made to evaluate the probability of radioiodine uptake in patients with thyroid cancers who cannot visit hospitals or clinics equipped with personnel and facilities to carry out radioiodine studies. In this way the therapeutic possibilities of radioiodine in this group of patients might be greatly extended.

One table.

Radioiodine Uptake by the Fetal Mouse Thyroid and Resultant Effects in Later Life. Harold Speert, Edith H. Quimby, and Sidney C. Werner. Surg., Gynec. & Obst. **93**: 230–242, August 1951.

Iodine ingested by the mother passes readily through the placenta and into the fetus. The thyroid gland begins to function during fetal life. Recent experiments with radioactive iodine have shown significant uptake of I^{131} by the fetus following the administration of tracer doses to the mother during pregnancy. The thyroid gland's increasing capacity to concentrate iodine exceeds the rate of growth of the gland, once specific thyroidal activity begins.

The authors injected pregnant mice with a single dose (usually 200 mc.) of radioiodine at various stages of pregnancy and measured the radioactivity in the fetus forty-eight hours later. Iodine concentration in the fetus occurred in animals injected on the sixteenth day of pregnancy but not earlier. This corresponds with the stage of development at which follicles begin to appear in the fetal thyroid. The rate of uptake of I^{131} increased rapidly as term was approached. Later reproductive performance was normal in the male offspring and possibly impaired in the female. The thyroids of the offspring exhibited fibrosis, later compensatory hyperplasia with adenoma formation, and ultimately colloid goiters. Chromophobe adenomas of the pituitary were discovered in one-third of the surviving offspring between the ages of nine and twelve months.

The authors state that the use of radioiodine in the treatment of pregnant human patients after the first trimester is to be considered unwise in the light of present knowledge, if the therapeutic objective can be attained by other methods of treatment.

Nineteen photomicrographs and photographs; 1 graph; 4 tables. JOHN D. REEVES, M.D.
University of Pennsylvania

Radioactive Phosphorus. II. In the Treatment of Myeloid Leukemia. Henry D. Diamond and Lloyd F. Craver. Cancer **4**: 999–1008, September 1951.

This paper is the second of a series of reports dealing with a long-term experience with radioactive phosphorus (P^{32}) in the treatment of malignant lymphomas and leukemias. [The first, dealing with lymphatic leukemia appeared in Cancer **3**: 779, 1950, and was abstracted in Radiology **57**: 299, 1951.]

This report deals with a ten-year experience at Memorial Hospital (New York) in the palliative therapy of myeloid leukemia. The study was begun Feb. 6, 1940, and ended on Nov. 30, 1950. It included 77 patients.

Of the patients with chronic myelogenous leukemia, only 9 were treated exclusively with P^{32}. An additional 50 patients were treated with P^{32} and other methods, such as high-voltage roentgen therapy, total body irradiation, and the various chemotherapeutic agents. The dosage of the radiophosphorus in this group was 0.1 mc. per kilogram of body weight. The total dose was divided into single daily doses approximating 1.0 mc., and the medication was given orally. The authors believe that P^{32} exerts a definite influence in the majority of cases on bone marrow and the peripheral white cell count. The over-all results with this mode of therapy are not different from those of other methods of therapy at the present time. When splenomegaly is present radiophosphorus treatment, if used, should be supplemented by local roentgen irradiation of the spleen.

In 10 of the 18 patients with acute myelogenous leukemia P^{32} only was used. The dosage was less than the 0.1 mc. per kilogram of body weight which was used in the patients with the chronic form of the disease. In this group P^{32} could not be demonstrated to exert any beneficial results.

Eleven charts; 6 tables. D. S. CHILDS, JR., M.D.
Rochester, Minn.

Excretion of P^{32} in the Bile of Rabbits Following Intravenous Administration. Ferrin B. Moreland, Joseph H. Gast, and Béla Halpert. Am. J. Clin. Path. **21**: 828–830, September 1951.

This study was undertaken to determine the rate of removal of P^{32} from the blood serum and the rate of its appearance in the bile. Following the intravenous administration of $H_3P^{32}O_4$ into rabbits, the radioactivity in the blood serum reached a maximum within about ten minutes and that in the bile from the common bile duct within about fifteen minutes. The rate of de-

crease in activity in the bile from the maximum value paralleled that of the serum. The activity of the serum was five to twenty-one times that of the bile. Bile from the gallbladder was intermediate in activity between the bile from the duct at the maximum and at the end of two hours.

One table; 1 graph.

Metabolism of Calcium in Normal, Rachitic and Vitamin D-Treated Rats as Evidenced by Radiocalcium Ca^{45} Studies. Elizabeth Underwood, Salomon Fisch, and Harold C. Hodge. Am. J. Physiol. **166:** 387–393, August 1951.

Various investigations have been made of the effect of vitamin D on calcium metabolism. In the present study, data were sought on the early phases of the vitamin D action by examining rats eight, twenty-four, forty-eight, as well as seventy-two hours after treatment. Three groups of animals were studied: (1) controls, non-rachitic, given cod-liver oil; (2) rachitic, given cod-liver oil; (3) rachitic, with no cod-liver oil. All rats were given calcium^{45}.

In agreement with current theory, the evidence obtained by the authors favors the view that vitamin D (*a*) in rachitic rats increases the absorption of calcium from the gastro-intestinal tract, (*b*) aids in mobilizing inorganic phosphorus from organic sources and (*c*) locally accelerates the mineralization of bone. Active healing of rachitic bone, as shown by the upswing in the curve of deposition of Ca^{45}, begins between the forty-eighth and seventy-second hour after the administration of the vitamin.

Seven charts; 2 tables.

Hematology of the Dog Following Intravenous Administration of Radioactive Colloidal Gold. Brownell Wheeler, Marvin A. Jackson, and Paul F. Hahn. Am. J. Physiol. **166:** 323–327, August 1951.

Fourteen mongrel dogs were injected intravenously with 1 mc./kg. of radioactive colloidal gold. All of the dogs showed a definite decrease in white blood cell count, but only 1 was thrown into a marked leukopenia. In 12 dogs the sedimentation rate increased following irradiation, although this response was not as clear cut as the decrease in white count. Hemoglobin and hematocrit decreased in a slow and progressive manner over a period of several weeks. Liver function tests failed to reveal any marked degree of hepatic impairment, but a few dogs showed changes indicative of mild liver damage. Some of the possible mechanisms for these changes are discussed briefly.

The results of this study show that the intravenous administration of radioactive colloidal gold at dosage levels similar to those employed therapeutically in leukemia and cancer is relatively well tolerated by normal dogs. It seems probable, therefore, that in so far as hematological changes and liver function are concerned these dosage levels present little immediate danger to patients receiving them.

One chart.

RADIATION EFFECTS

Osteogenic Sarcoma Following Prophylactic Roentgen-Ray Therapy. Report of a Case. Sophie Spitz and Norman L. Higinbotham. Cancer **4:** 1107–1112, September 1951.

The incidence of radiation cancer occurring in tissues underlying the skin has been emphasized only recently. In view of the fact that, with supervoltage technics, depth dosages are no longer limited by skin tolerance, and have therefore been significantly elevated, the occurrence of an osteogenic sarcoma in previously normal bone that was the target of prophylactic roentgen therapy is felt to be worthy of report.

The patient was a 46-year-old white male who, four years before the onset of the present illness, was discovered to have a tumor of the right testicle which was removed surgically and found on pathologic examination to be a seminoma. Following the operation, prophylactic million-volt roentgen therapy was given. A dose of 4,900 r was delivered to each of five skin portals with cross-firing into the retroperitoneal node-bearing areas so that the tumor dose was calculated to be 4,400 r at the level of D-11, 5,289 r at L-4, and 3,281 r at the suprapubic level. The patient remained in good health for four years following completion of this treatment.

When seen by the authors, the patient had been complaining, for seven months, of a constant severe pain which radiated from the back down the right leg. A chordotomy had been performed a month earlier, with relief for a very short time. Roentgenograms of the spine had been taken at frequent intervals after the onset of pain, but osseous changes were noted only one month before admission of the patient to Memorial Hospital, with an area of decreased density in the articular process of L-3. The extent of bone destruction progressed over the next few months until the lamina of L-3, L-4, and L-5 were involved. Minute calcific flecks were present in adjacent soft tissues and there was distinct bulging of the right psoas shadow. Nodular densities suggestive of pulmonary metastasis were observed in both lung fields.

The patient died fifty-five months after the completion of the postoperative prophylactic roentgen therapy. Histologic examination of tissue taken from the vertebrae showed the appearance of an osteogenic sarcoma. There was no evidence of recurrent or metastatic seminoma.

The authors point out that seminoma is a radiosensitive tumor and suggest that prophylactic roentgen therapy, if used at all in such cases, be limited to dosage levels that will not jeopardize the integrity of normal tissues within its beam.

One roentgenogram; 5 photomicrographs.

D. S. CHILDS, JR., M.D.
Rochester, Minn.

Extraskeletal Osteogenic Sarcoma Arising in Irradiated Tissue. Oscar Auerbach, Milton Friedman, Leo Weiss, and Harold I. Amory. Cancer **4:** 1095–1106, September 1951.

The occurrence of extraskeletal osteogenic sarcoma arising in previously irradiated soft tissue has not been reported hitherto to the authors' knowledge. Their patient was one in a series with testicular tumors, who, after removal of the primary tumor—in this case

seminoma—received intensive roentgen therapy aimed at the periaortic and pericaval nodes. A total dose of 4,000 r was delivered to each of five skin portals over a period of seventy days.

The patient was well for about four years after treatment, when he began to experience aching over the dorsal spine. Five months later, examination revealed a mass in the area of the lower dorsal spine, firmly fixed to the deep structures, at a point directly beneath the center of a portal which was used in the previous roentgen-ray treatment. The mass grew slowly and was stony hard. Roentgenographic examination revealed calcium within it, in linear streaks. The biopsy report was osteogenic sarcoma.

The patient died three years after the onset of the osteogenic sarcoma and seven years after orchiectomy for seminoma. Postmortem examination revealed an osteogenic sarcoma which had developed in a previously heavily irradiated area and which was extraskeletal in origin.

Five roentgenograms; 8 photographs; 5 photomicrographs. D. S. CHILDS, JR., M.D.
Rochester, Minn.

The Vomiting Center: Its Destruction by Radon Implantation in the Dog Medulla Oblongata. S. C. Wang and Herbert L. Borison. Am. J. Physiol. **166:** 712–717, September 1951.

Recent developments in the therapy of motion sickness have stimulated new interest in the central mechanism of vomiting. The location of the vomiting center is no longer merely an academic question, but has become one of practical importance in the rational use of drugs for the relief of vomiting. The authors previously demonstrated, by electrical stimulation and with ablation by electrocautery, that the vomiting center is located in the dorsolateral portion of the reticular formation of the medulla oblongata. This finding is not in agreement with the contention of some other writers that the dorsal sensory nucleus of the vagus constitutes the emetic center.

Cauterization of the reticular emetic apparatus as done by the authors necessarily involved destruction of tissue in the floor of the fourth ventricle, including the dorsal vagal nuclei, making difficult an adequate differential analysis of function between these medullary regions. To overcome this objection, a technic of radon seed implantation, by means of which it is possible to produce slowly progressive lesions in the interior of the medulla oblongata without injury to the periventricular structures, was developed. With this method the lesions are relatively discrete and the extent of damage is predictable. Dogs with such lesions placed accurately and bilaterally in the dorsolateral portion of the reticular formation showed no response to intravenously administered apomorphine and were also refractory to large doses of copper sulfate given via the gastric route. Thus, the location of the vomiting center is further confirmed to be in the medullary reticular formation.

The Electrolytic Resistance of the Blood Clot in Polycythemia Vera Before and After Radiation and Its Relationship to Clot Retraction. Henry H. Henstell, Irma S. Henstell, and Edward M. Ornitz, Jr. Am. J. Clin. Path. **21:** 820–827, September 1951.

When fresh whole blood is permitted to clot upon and about platinum electrodes, an electrolytic resistance develops across the electrodes. This phenomenon, called the electrolytic resistance of the blood clot, appears to be due primarily to the degree and strength of clot retraction. A previous study showed that in thrombocytopenia, either hypersplenic or secondary to bone marrow disease, the clot resistance, concomitantly with clot retraction, is greatly reduced. In the present investigation it was found that an increase in the electrolytic resistance of the whole blood clot occurs in untreated polycythemia vera. This is associated with an increase in the strength of clot retraction, as indicated by a decrease in the percentage clot volume of the whole blood. Similar changes are sometimes observed in chronic myelocytic leukemia.

No correlation was evident between the clot resistance and the platelet count or between the percentage clot volume and the platelet count.

Both total body x-ray irradiation and radioactive phosphorus (P^{32}) decreased the strength of clot retraction in polycythemia vera, as indicated by a decrease in the clot resistance and an increase in the percentage clot volume. These are independent of the effect of radiation upon the red cell values.

The authors suggest that increased clot retraction is a characteristic of polycythemia vera and that factors other than the concentration of platelets are important in clot retraction.

Three graphs; 2 tables.

Hematologic Changes in Rats Protected by Cysteine Against Total Body X-Irradiation. Robert L. Rosenthal, Leontine Goldschmidt, and Bryant I Pickering. Am. J. Physiol. **166:** 15–19, July 1951.

The present investigation was undertaken to determine whether any modification in the response of the hematopoietic system to x-ray accompanies or is related to the decrease in mortality achieved by administering cysteine to rats exposed to total-body irradiation.

Rats weighing between 200 and 300 gm. were injected intravenously in pairs one hour before irradiation. One animal of each pair was given 1 c.c. of 5 per cent saline and the other 875 mg./kg. of *l*-cysteine in 1 c.c. of solution at pH 7. All animals received 800 r total-body irradiation, with the following factors: 250 kv., 15 ma., 0.5 mm. copper filter, dose rate about 200 r per minute measured in air with a Victoreen ionization chamber, and a target-to-skin distance 35 cm. The thirty-day mortality was 69 per cent for the saline-injected rats, and 0 per cent for the cysteine-injected rats.

Three days after irradiation, the blood of the cysteine-injected animals showed almost three times as many neutrophils as that of the saline-treated animals. No significant difference was apparent in the lymphocyte counts, although the values obtained were slightly higher in the cysteine-treated animals. Similar results were obtained seven days post-irradiation. Comparison of heart blood with tail blood revealed consistently higher neutrophil and lower lymphocyte values for tail blood in both groups of irradiated animals. In unirradiated controls, however, both neutrophils and lymphocytes were more numerous in the tail blood than in the heart blood. The cysteine-injected rats showed more numerous myeloid cells of

all stages in the bone marrow than did the saline-injected animals.

The possible significance of these findings in relation to infection and irradiation mortality is discussed.

Three tables.

Effect of Whole Body X-Irradiation on Serum Iron Concentration of Rats. Alfred Chanutin and Stephan Ludewig. Am. J. Physiol. **166:** 380–383, August 1951.

Serum iron concentrations were determined in male and female rats exposed to total body irradiation with x-rays in doses varying from 10 to 1,500 r. The average values were significantly increased in both groups during the first day following irradiation with doses of 100 r or greater. Subsequently, the serum iron concentrations remained elevated for about a week in the 500- and 600-r groups. Male animals appeared to be more sensitive to irradiation as judged by the increased values for serum iron.

One table.

Adrenal Cortical Function and Radiation-Induced Lymphoid Tumors of Mice. Henry S. Kaplan, Sumner N. Marder, and Mary B. Brown. Cancer Research **11:** 629–633, August 1951.

This report is concerned with a series of four experiments designed to study the role of adrenal cortical function in the development of lymphoid tumors.

It was found that the injection of cortisone either concurrently with or six weeks after total body x-irradiation significantly inhibited the development of lymphoid tumors in strain C57 black mice. No tumors occurred in mice treated with cortisone alone. Cortisone injection failed to modify the low lymphoma incidence observed after irradiation localized either over the mediastinum alone or over the whole body with the mediastinum shielded.

Bilaterally adrenalectomized strain C57 black mice exhibited a striking increase in mortality and a significant augmentation of lymphoid tumor incidence after total body irradiation.

Adrenal cortical extract and desoxycorticosterone acetate did not influence radiation-induced lymphoid tumor incidence under the experimental conditions employed.

Three graphs; 4 tables.

Inhibition by Testosterone of Radiation-Induced Lymphoid Tumor Development in Intact and Castrate Adult Male Mice. Henry S. Kaplan and Mary B. Brown. Cancer Research **11:** 706–708, September 1951.

Intact and castrate male C57 black mice were irradiated (673 r whole-body irradiation delivered in four equally fractionated treatments at intervals of four days) and injected twice weekly for ten weeks with an aqueous testosterone suspension. Corresponding littermate control groups were also irradiated and injected with a placebo of the suspension medium alone. Net lymphoid tumor incidence by groups was: (a) intact + x-ray + placebo, 39 of 52 mice (75 per cent); castrate + x-ray + placebo, 45 of 52 mice (87 per cent); (c) intact + x-ray + testosterone, 4 of 49 mice (8 per cent); and (d) castrate + x-ray + testosterone, 5 of 50 mice (10 per cent). Some possible mechanisms for the pronounced inhibitory effect of testosterone are briefly discussed.

One chart; 1 table.

Relation of Mitotic Activity to the Effects of X-Rays and Nitrogen Mustard as Indicated by the Growth of Corn Seedlings. Mary A. Russell and Francis J. Michelini. Cancer Research **11:** 687–693, September 1951.

The purpose of the investigation described here was to compare the sensitivity of tissue containing many dividing cells with the same kind of tissue in which little or no cell division was present at the time of exposure to either x-rays or nitrogen mustard. The root of the corn seedling was chosen for the test object because tissue may be obtained with no cell division or with varying percentages of dividing cells by controlling the length of the germination period or by chemical treatment.

A comparison of seedlings containing dividing cells exposed to irradiation with those treated with HN_2 showed that the percentages of roots which stopped growing were nearly the same. The average length of the primary roots at the time of death and the number of seedlings in which lateral root growth was entirely suppressed were approximately equal in the two groups. Since about the same amount of injury resulted from the administration of the two agents, the doses of x-ray and HN_2 used in these experiments with 16-hour germinated embryos are biologically equivalent. If, however, younger embryos containing no dividing cells were used, a considerably larger dose of HN_2 was required to kill the same percentage of roots.

While 3,500 and 4,000 r were used to stop the growth of 73 per cent of the 16-hour germinated embryos, only 1,700 and 1,750 r were required to produce the same mortality in the group with normal rate of mitosis. The greater sensitivity of the older seedlings may be due, in part, to the increase in hydration and general metabolic rate, but it is probable that most of the increased sensitivity can be attributed to the higher mitotic rate.

The authors conclude that the ratios between biologically equivalent doses of x-rays and a mustard compound may vary widely for the same tissue if its mitotic index is raised or lowered.

Three charts; 5 tables.

A Method of Obtaining Reproducible Breath Radon Samples. John H. Harley, Evelyn Jetter, and Merril Eisenbud. Arch. Indust. Hyg. & Occup. Med. **4:** 1–9, July 1951.

Investigation of four methods of sampling expired air showed that simple inhalation of 10 successive breaths through a 1-liter flask gave as constant results as the more elaborate methods which have been proposed in the literature.

The presence of radon in the environmental air was the most significant cause of variability of samples collected from individuals whose radium burden was known to be constant. A method of eliminating this factor has been devised, that of using radon-free air and a respirator. This method was also found to reduce the variability of successive replicate samples, allowing the study of other variables.

The day-to-day variation of samples from a person

with a high fixed burden was found to be detectable, but not of significance for routine sampling.

The usual week-end period away from exposure reduced the body radium content to within 25 per cent of the fixed burden. The usual Monday morning sample is considered to approximate validly the fixed radium burden.

On the basis of their findings, the authors have adopted the "respirator" method of sampling for routine use. Samples are collected after sixty-four hours of non-exposure. These changes in the sampling have yielded data from which the variability formerly characteristic of breath radon samples is conspicuously absent.

One illustration; 9 tables.

The Maximum Permissible Exposure to Radiation. Larkin Kerwin. J. Canad. A. Radiologists **2**: 21–23, June 1951; 38–42, September 1951.

In this work the author carefully defines the roentgen, the rep, and the rem, pointing out that they are not interchangeable units and why. The roentgen is a measure of ionization intensity in air and cannot be applied to measure biological effects. The rep (roentgen-equivalent-physical) is a measure of ionization intensity in tissue, which varies with the type of tissue as well as with the quality of radiation. This unit can be used to calculate ionization from corpuscular radiation (alpha and beta), using the known average energy and range of the particles and the number of particles given off per unit of time. The rem (roentgen-equivalent-mammal) was devised to allow for the differences in type of ionization. Since alpha and beta particles have distinctively different ways of producing their molecular effects, their biological effects are not produced by equal quantities of radiation. When enough experimental work has been done and tabulated, the rem will probably be a useful unit in probing deeper into the effects of radiation on tissue.

In measuring radiation it is important to use devices which are calibrated for the energy value and type of radiation in equation; otherwise, erroneous results will be obtained. Dosage rate meters are recommended in preference to film badges for protection purposes, since the film gives information as to overexposure only after it has occurred.

Two methods of arriving at a maximum permissible exposure have been in use. The first consists in determining an exposure factor which has been known over a long period to produce no adverse effect and, if desired, adding a safety factor. The second method, which is more scientific, consists in finding experimentally just what amount will produce any observable ill effects, if possible determining the threshold dosage for such effects, and allowing a safety factor.

On the basis of the first method it had been agreed that 0.1 r per day or 2.5 r per month was a safe figure, but recent work on the effects of radiation indicates that this figure is too high and represents in general a safety factor of less than ten and possibly less than five for dangerous effects.

The present figure for allowable exposure for those in the profession is 0.3 r per week, with higher local doses permitted to radiologists and physicians under certain circumstances (*e.g.*, hands, if whole body radiation is kept low). For the general public 0.1 r per week is recommended as a maximum figure. This would minimize genetic and other effects "in the unlikely event of large sections of the population being constantly irradiated by future radioactive installations."

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